

TRACE-P, March–April 2001

P–3B Flight tracks, narratives, and meteorological summaries



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Satellite imagery collected by David Westberg

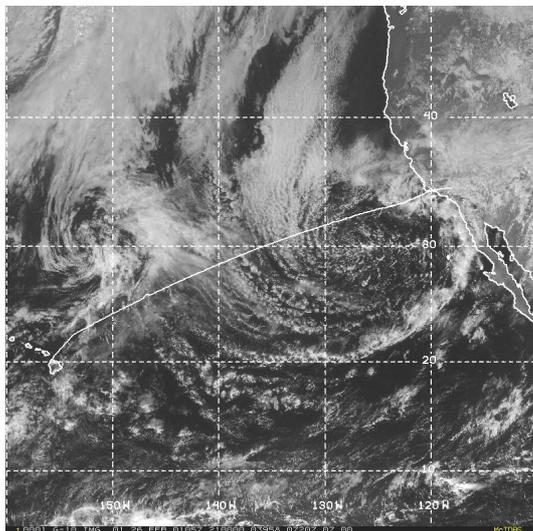
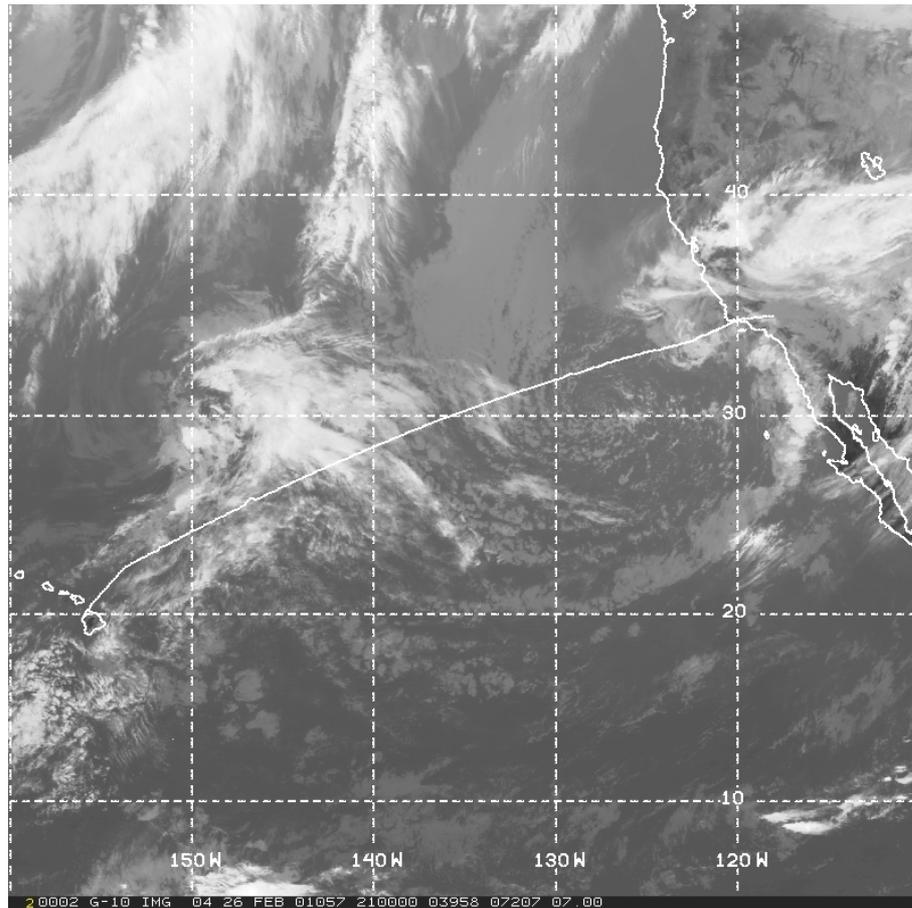
Text by James Crawford, Reg Newell, and David Westberg

Document prepared by Martin Schultz

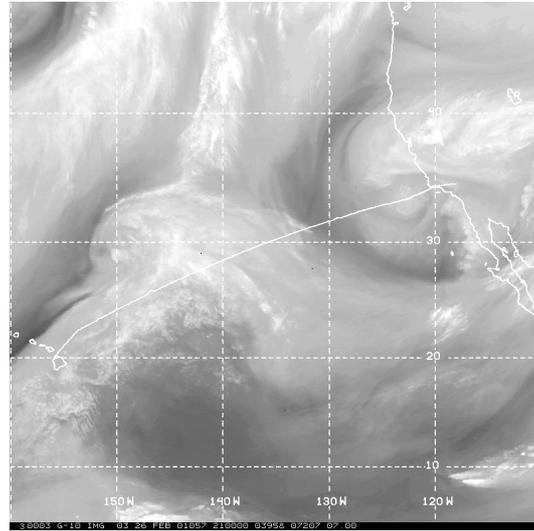
26 FEB 2001

P-3B: flight 05, Palmdale-Kona, transit (20010226-20010226)

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P-3B flight 05 Narrative

All three planes transited from Dryden/Palmdale to Kona, Hawaii for an overnight stop. During transit flights for the P3-B, primarily they are direct flights with altitude changes from 500 feet to 20,000 ft. with each flight level lasting approximately 20 minutes. There are also transitions from the top and bottom altitudes at 500 ft./min.

Flight summary:

To provide for several soundings over the eastern Pacific, three in-progress walls were planned for this transit flight. Model products indicated that some evidence of Asian outflow might be found somewhere between the west coast and Hawaii.

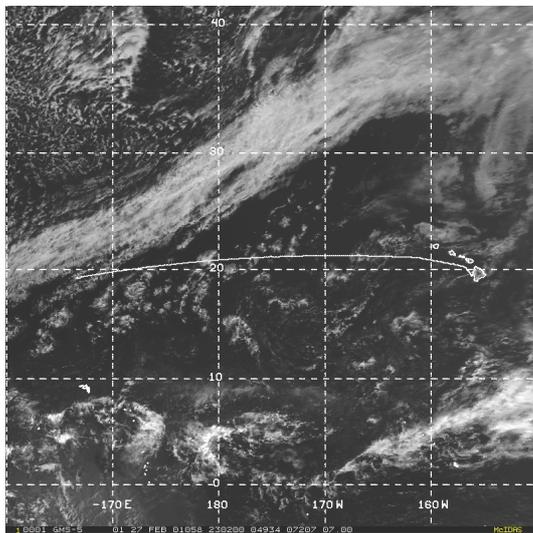
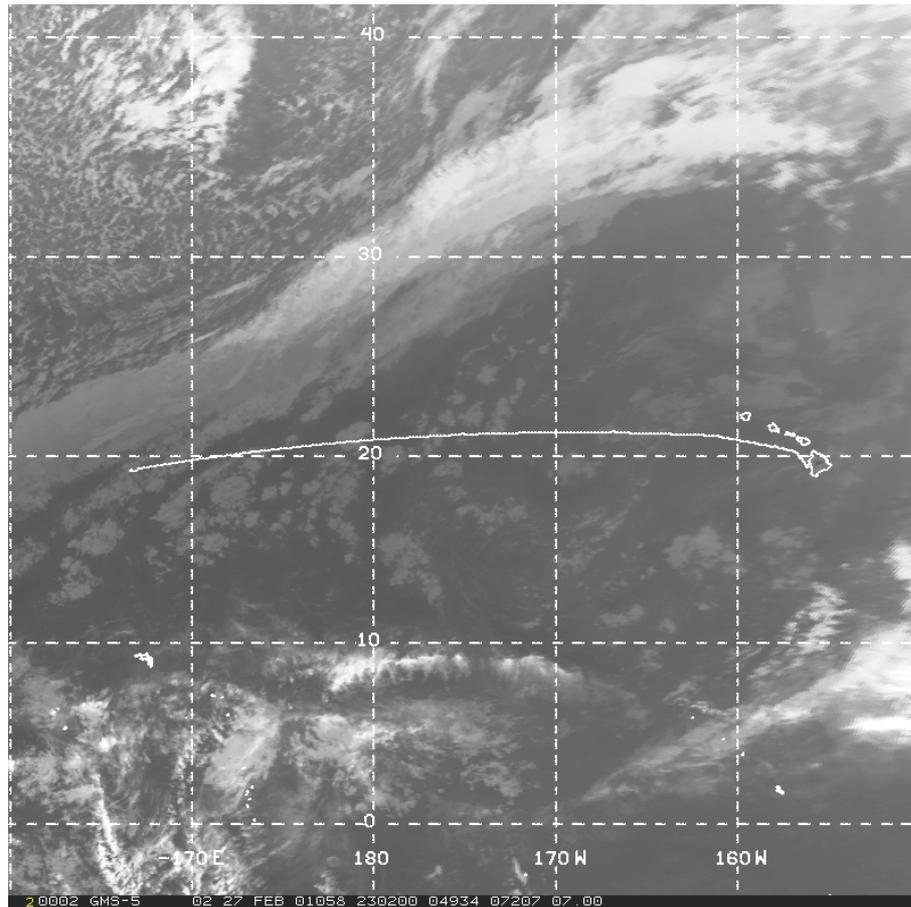
Results:

Fairly clean conditions were encountered during this flight; however, a distinct layer was encountered on the second in progress wall between 12.5-13.5Kft. This layer contained elevated concentrations of CO, NO_y, and PAN and was located in the region of model-predicted outflow.

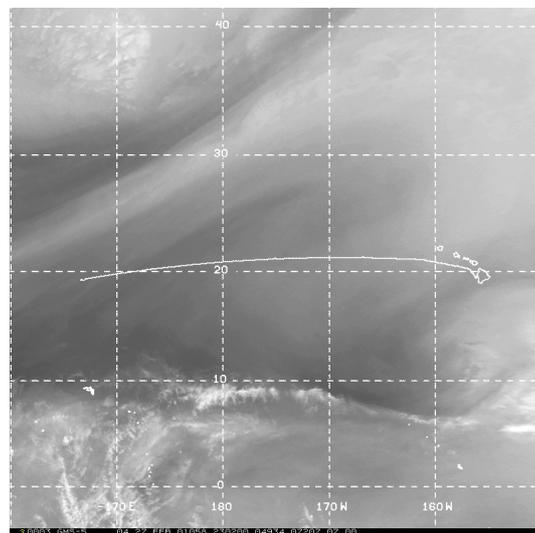
27 FEB 2001

P-3B: flight 06, Kona-Wake Island, transit (20010227-20010228)

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P-3B flight 06 Narrative

As in other transit flights, several in-progress walls were planned for this transit flight. Model products indicated that some Asian outflow might be encountered just west of Hawaii, but that mostly clean conditions should prevail.

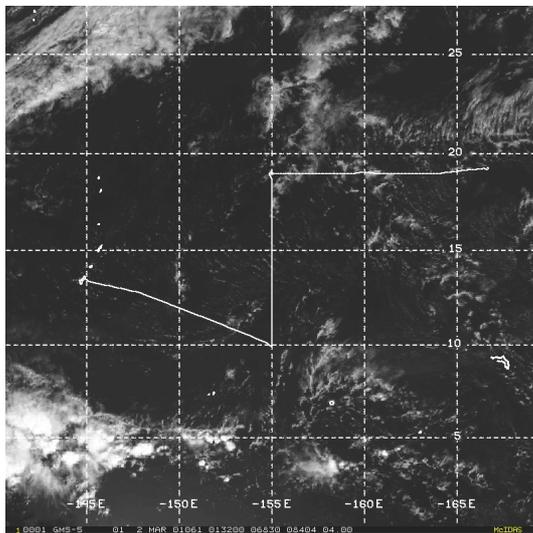
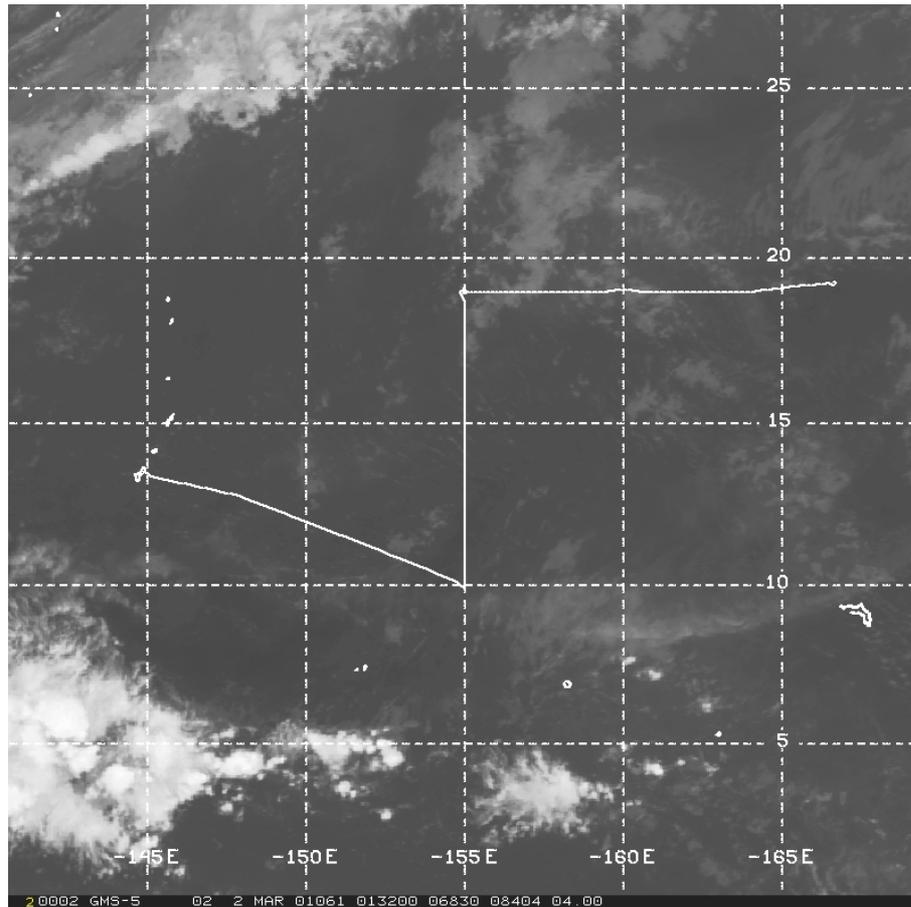
Results:

As expected, clean conditions prevailed over much of the flight, but an unexpected layer of pollution was found at 10Kft. This layer was extremely thin (only 1,000ft) and persisted over the entire distance from Kona, Hawaii to Wake Island. Wind speeds in this layer were often less than 1 knot signalling this to be a stagnant layer trapped between subsiding air above and a strong inversion at 7Kft.

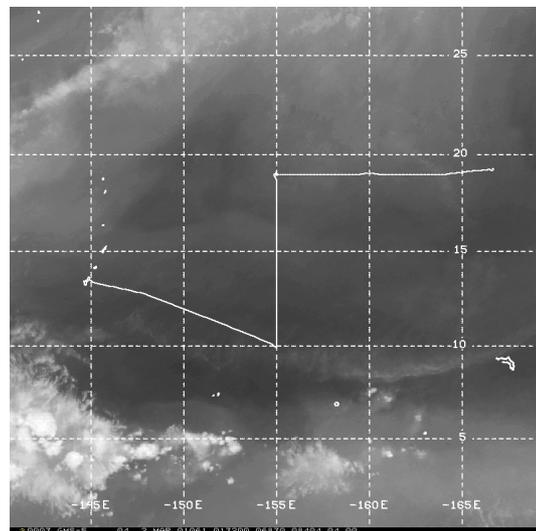
01 MAR 2001

P-3B: flight 07, Wake Island-Guam, transit (20010301-20010301)

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P-3B flight 07 Narrative

The C130 left the day before to provide support for the DC-8 that had flown directly from Kona to Guam and possibly position itself for getting in early at Hong Kong (HK) to obtain badges before the office closed for the weekend. Because of ongoing last minute questions from Peking the final authorization for landing in HK was held up and that flight was put on hold.

Flight Summary:

This flight was planned to evaluate the southernmost extent of outflow influencing the central North Pacific. This was to be accomplished through an in-progress wall flown due west to find any pollution layers, a constant altitude leg due south between 19N and 10N latitude to observe the transition from Asian influence to tropical conditions, and another in-progress wall into Guam sampling clean tropical air.

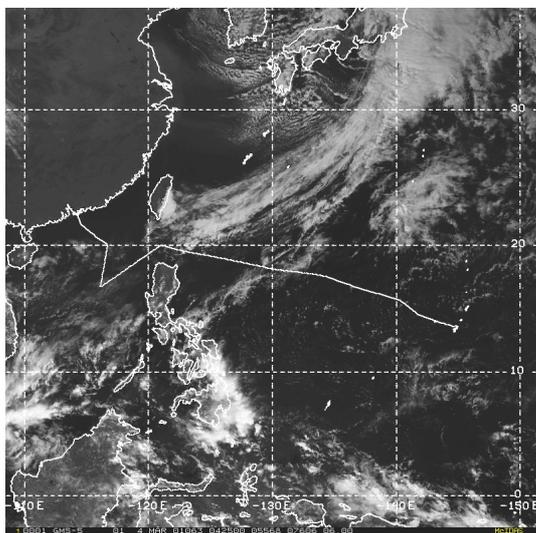
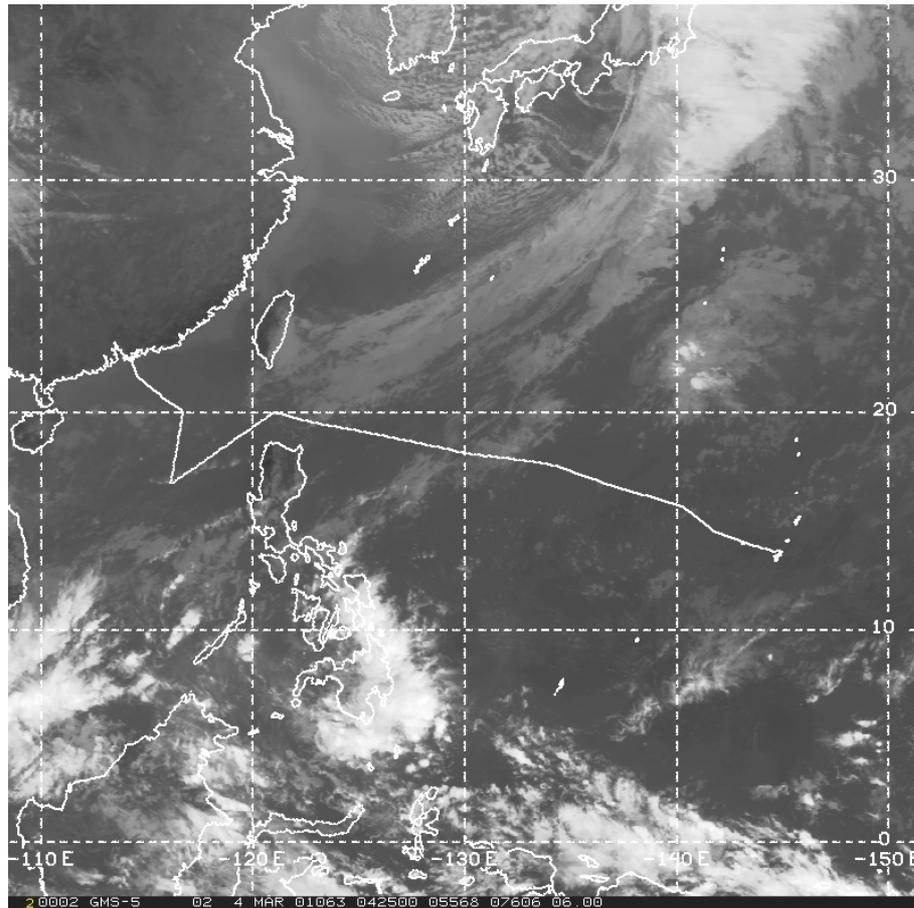
Results:

Evidence of Asian outflow on the in-progress wall heading east from Wake Island was not compelling in terms of CO, but a layer of elevated NO_y and ozone was located at 18Kft. Flying at this altitude on the southbound leg revealed a distinct transition to cleaner conditions around 13.5N latitude. Despite this transition, the in-progress wall into Guam was not dramatically cleaner than conditions flying out of Wake Island further to the north.

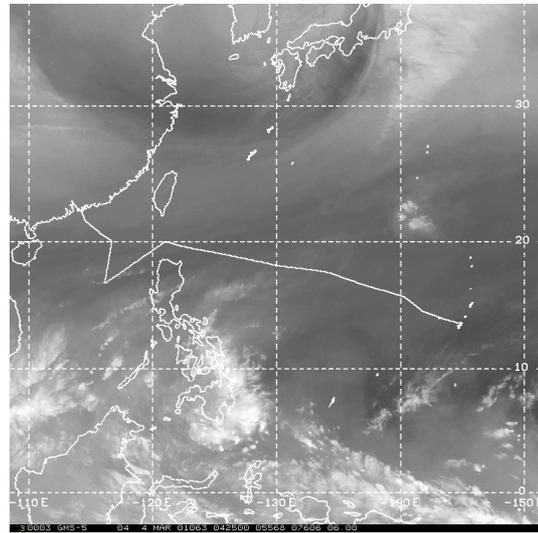
04 MAR 2001

P-3B: flight 08, Guam-Hong Kong, transit (20010304-20010304)

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P-3B flight 08 Narrative

Because of the efforts of the U.S. consulate in HK, the HK government working with representatives in Peking, and the International Affairs Office at NASA HQ working through the state department, necessary information was provided to the Chinese government in Peking that helped in the granting of permission for the three aircraft to land and operate out of HK. All three planes arrived Sunday afternoon and parked on the tarmac across a taxiway from active gates for regularly scheduled airplanes. The airport provides bus transportation between the airplanes and the terminal.

Flight Summary:

An intercomparison was planned for the beginning of the flight with both P-3B and DC-8 flying in the marine boundary layer at 500 ft with 2000 ft separation. This leg was planned for 20 minutes to be followed by another in-progress 20 minute climb to 10,000 ft. The remainder of the flight included crossing a weak frontal transition and a southbound leg reaching into the South China Sea before heading into Hong Kong.

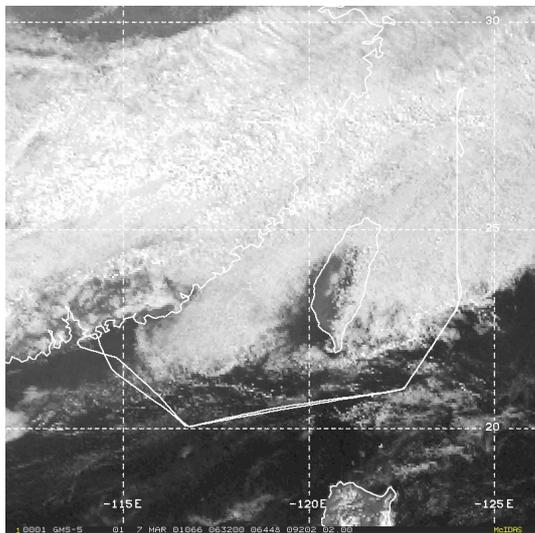
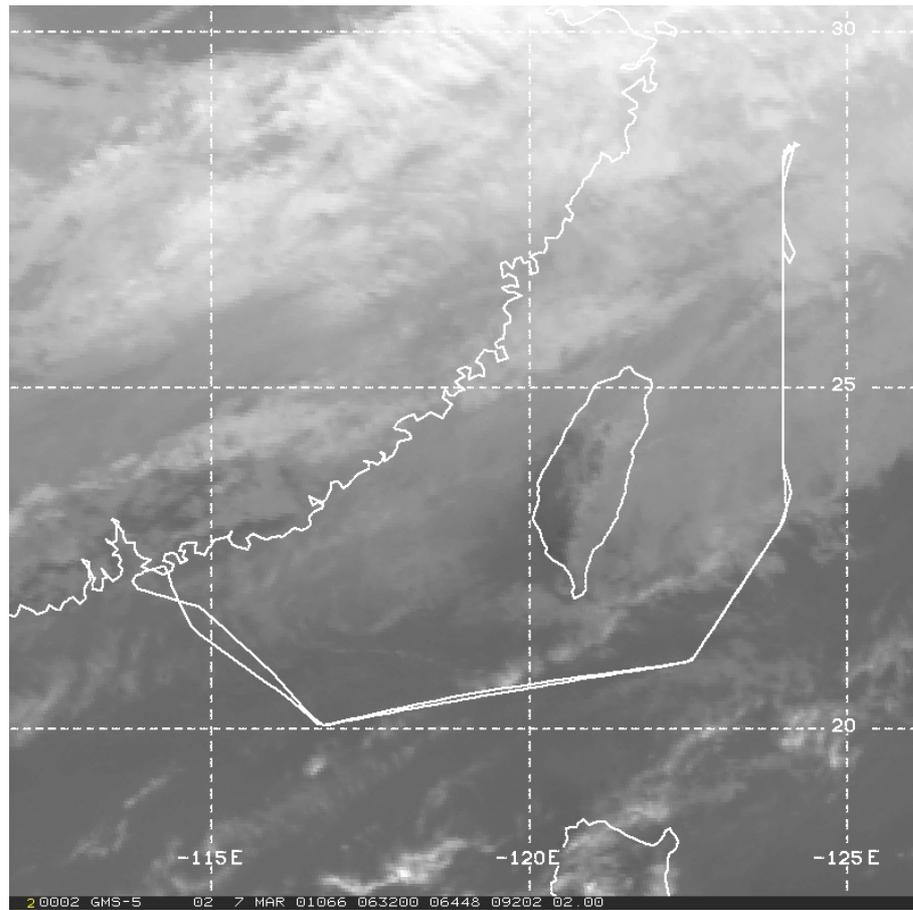
Results:

The intercomparison portion of the flight went well with clean conditions on the boundary layer leg and significant variability on the sounding from 500-10,000 ft. Observations in the weak frontal transition zone did not show any clear pre- to post-frontal changes in composition. Entering the South China Sea, persistent pollution was encountered between 8000 ft and the surface with the highest levels of CO, NO_y, and particulates yet to be observed.

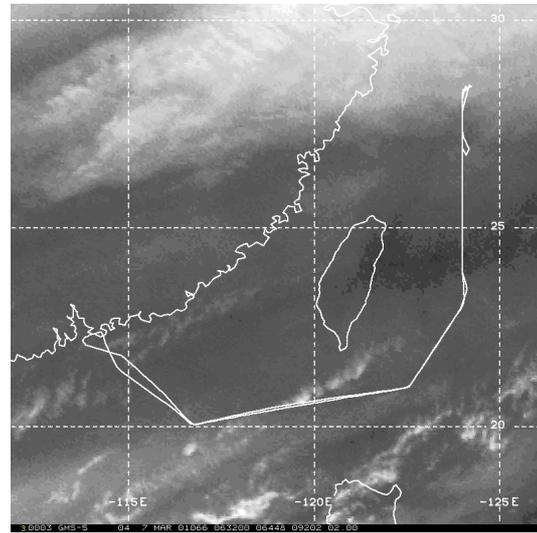
07 MAR 2001

P-3B: flight 09, Hong Kong local 1 (20010307-20010307)

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P-3B flight 09 Narrative

Flight Summary:

This flight was intended to sample Asian outflow behind a frontal passage with the P-3B extending northward to the east of Taiwan and crossing the frontal boundary expected near 25N.

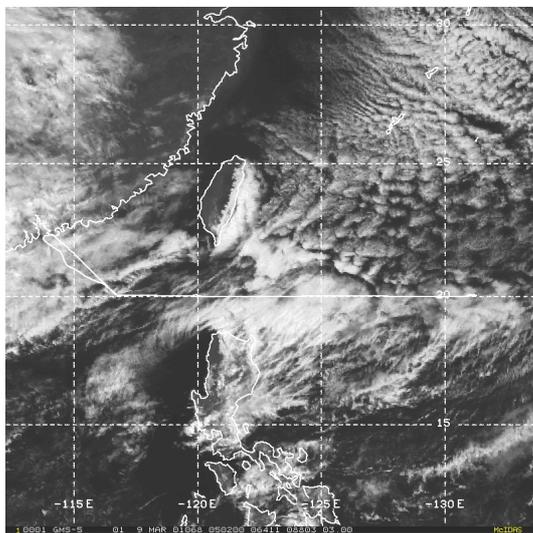
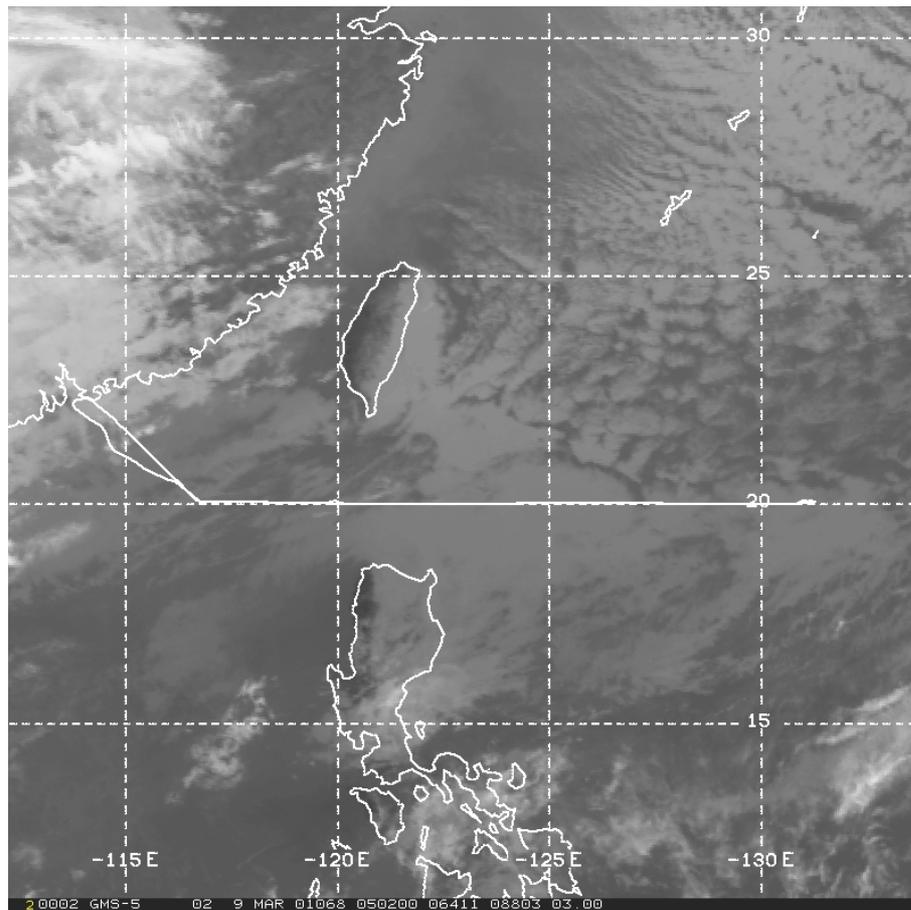
Results:

Observations included upper tropospheric conditions (15Kft) representative of tropical air to begin the flight (CO-70s, O3-20s). Polluted conditions were first encountered around 10Kft at 22N (CO-300s, O3-90s). In the frontal region, cloud modulation of composition was recorded with changes in CO of 75% and doubling of NO_y in and out of convective cells. CO values to the north behind the front were in the high 200-300 range. On the return to Hong Kong a well defined pollution layer only 1000 ft in thickness was encountered at 9Kft. Values in this layer for CO were double those encountered in the boundary layer and ozone values were almost quadrupled compared to BL values. On the last boundary layer leg, a ship plume was encountered that lasted 15 seconds with enhancements in NO_y, particles, SO₂, and CO₂ as well as a significant titration of ozone.

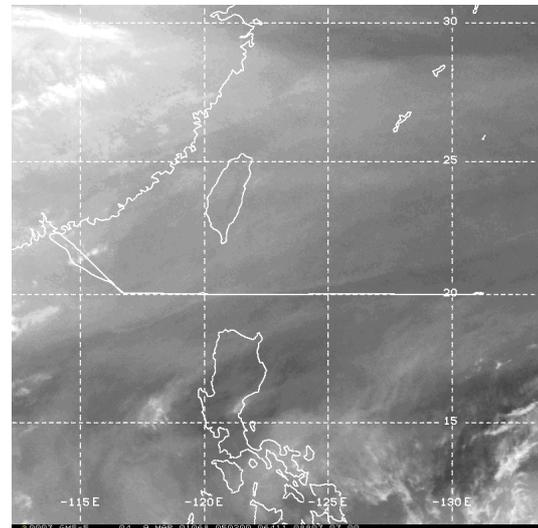
09 MAR 2001

P-3B: flight 10, Hong Kong local 2 (20010309-20010309)

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P-3B flight 10 Narrative

Flight Summary:

A series of in-progress walls were planned along 20N latitude to the east of Hong Kong. Model predictions indicated aged post-frontal outflow in the middle troposphere should be encountered.

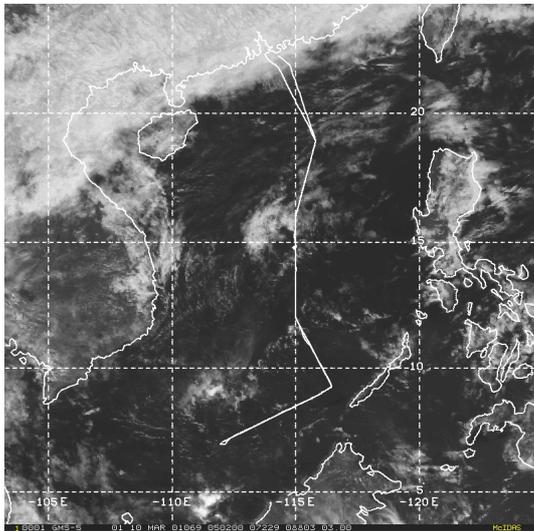
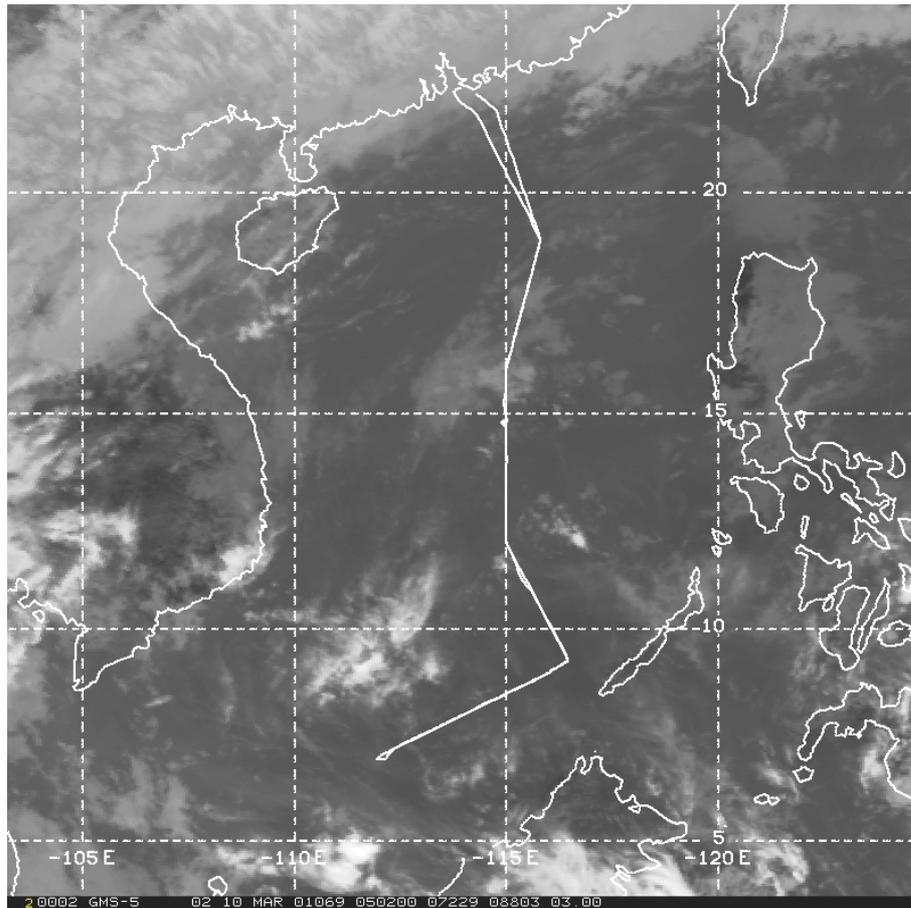
Results:

Model predictions were found to be accurate for the middle troposphere. The P-3B encountered polluted outflow between 7.5–12.5Kft. Clean conditions were encountered above 12.5Kft. Pollution encountered in the boundary layer was not predicted, but appeared to be due to ship traffic. Highly correlated behavior between NO_y, SO₂, and particulates was observed along with several ship sightings. NO_x/NO_y ratios indicated emissions probably too fresh to have been transported from the Asian continent.

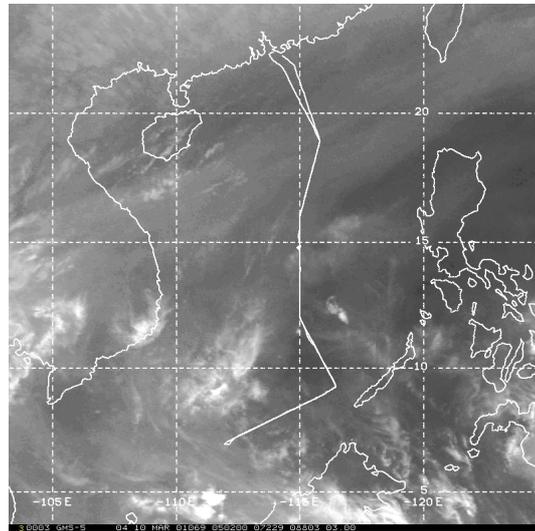
10 MAR 2001

P-3B: flight 11, Hong Kong local 3 (20010310-20010310)

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P-3B flight 11 Narrative

Flight Summary:

A flight southward over the South China Sea was planned to look at outflow during a quiescent period. Model predictions indicated clean condition in the free troposphere with some pollution trapped in the marine boundary layer.

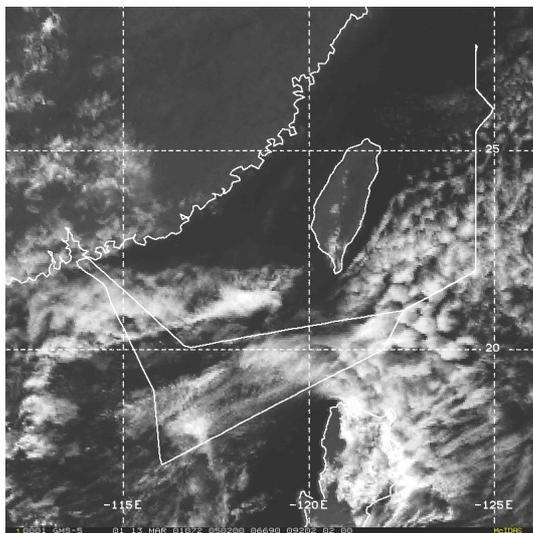
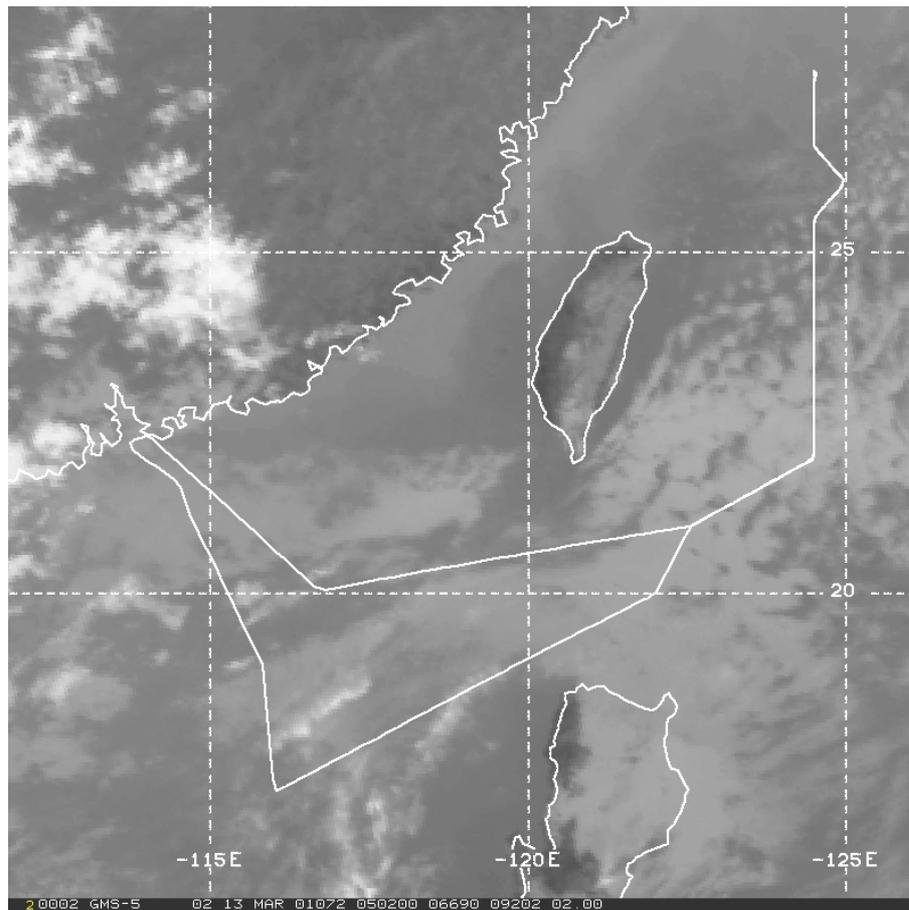
Results:

As expected, clean conditions prevailed over much of the flight, and pollution in the boundary layer was encountered at latitudes consistent with outflow from Manila in the Philippines. Differences in boundary layer measurements on the outbound and return legs were suggestive of some photochemical evolution with slightly elevated ozone mixing ratios well correlated with NO_y and particulates. Some ship encounters in the boundary layer were also noted in the data.

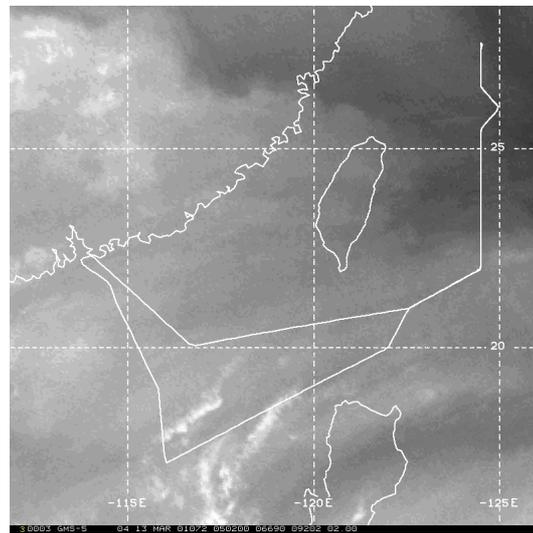
13 MAR 2001

P-3B: flight 12, Hong Kong local 4 (20010313-20010313)

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P-3B flight 12 Narrative

Flight Summary:

The P-3B took a track heading north to the east of Taiwan along 124.5E. This track was selected to attempt to sample a stratospheric intrusion expected just north of 26N. Returning to Hong Kong a short leg of high altitude sampling into the South China Sea was planned to look for potential biomass burning outflow.

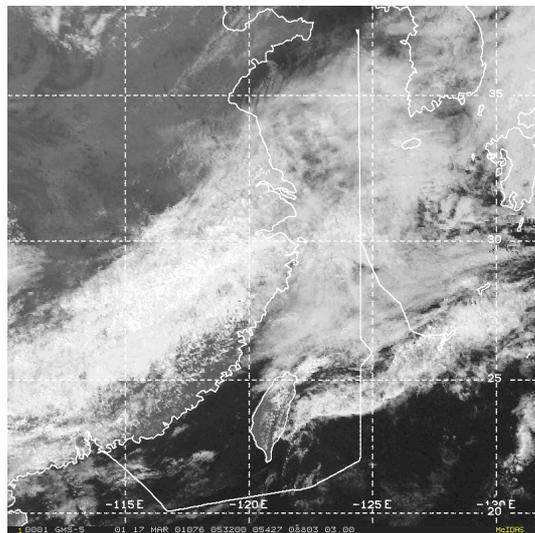
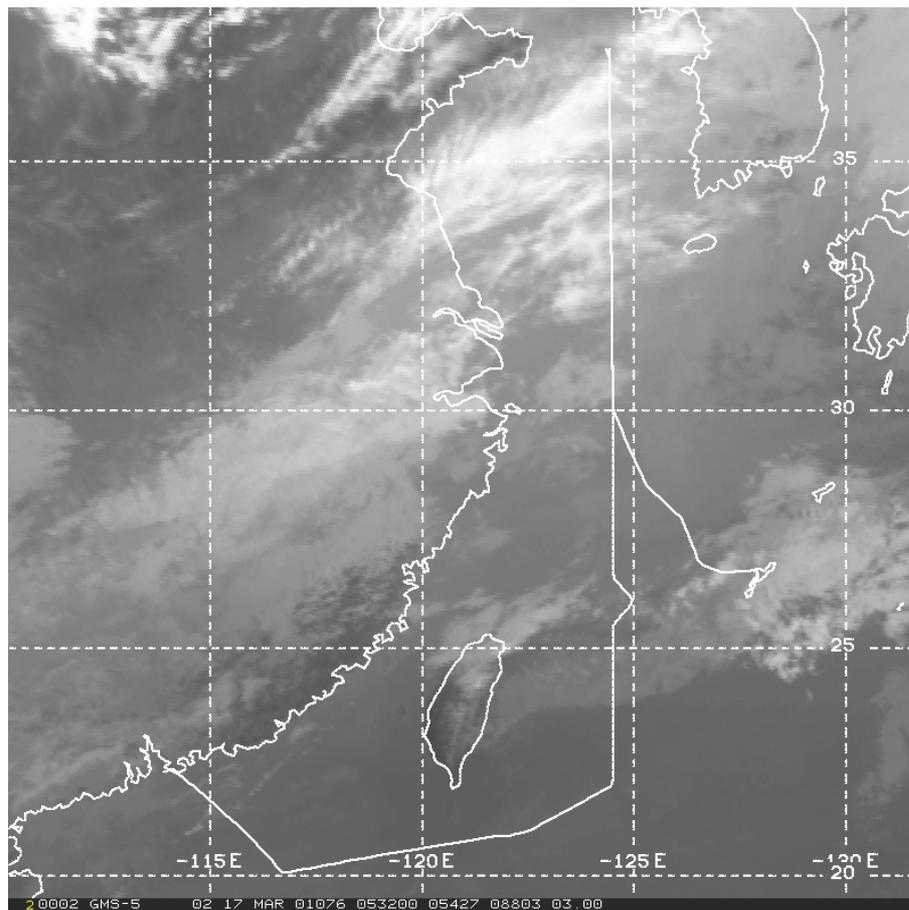
Results:

A layer of elevated CO and NO_y was observed on the initial ascent between 7 and 10Kft. This layer was not present on the initial descent about 1 hour later. As in previous flights to the east and north, boundary layer legs were characterized by high variability in NO, NO_y, SO₂, and CN suggestive of shipping lanes. Numerous ship sightings were also reported from the cockpit. An uncooperative air traffic control representative prevented sampling of the expected stratospheric intrusion by forcing the P-3B to stay below 7.5Kft north of 26N. On reaching the South China Sea, conditions were fairly clean up to 20Kft with CO decreasing with altitude. Between 20-24Kft, a few thin layers were observed with elevated CO, NO, NO_y, O₃, and CN. Although not dramatic, CO at 24Kft was higher than that at 20Kft. Another layer at 22Kft contained enhanced O₃ and NO_y which were anticorrelated with dew point.

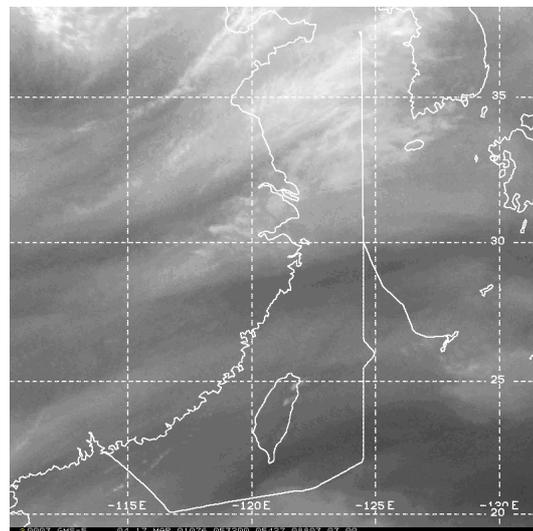
17 MAR 2001

P-3B: flight 13, Hong Kong–Okinawa, transit (20010317–20010317)

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P-3B flight 13 Narrative

Flight Summary:

This flight between Hong Kong and Okinawa was planned to include a northbound leg along 124.5E beginning at 22N to the east of Taiwan stretching into the Yellow Sea up to 37N, then south again into Okinawa. Model products predicted strong low level outflow north of 25N and centered between 4-12Kft.

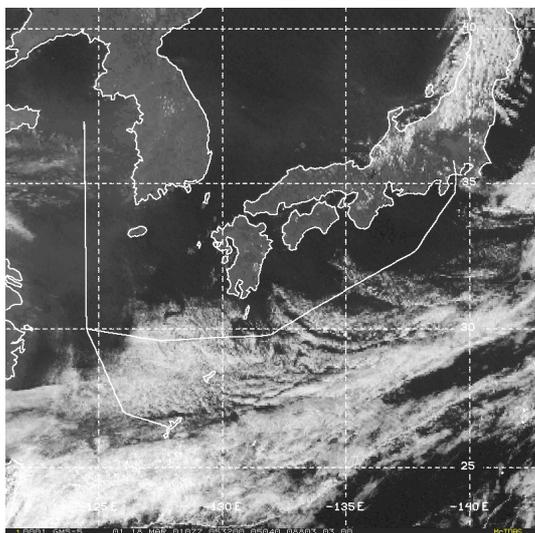
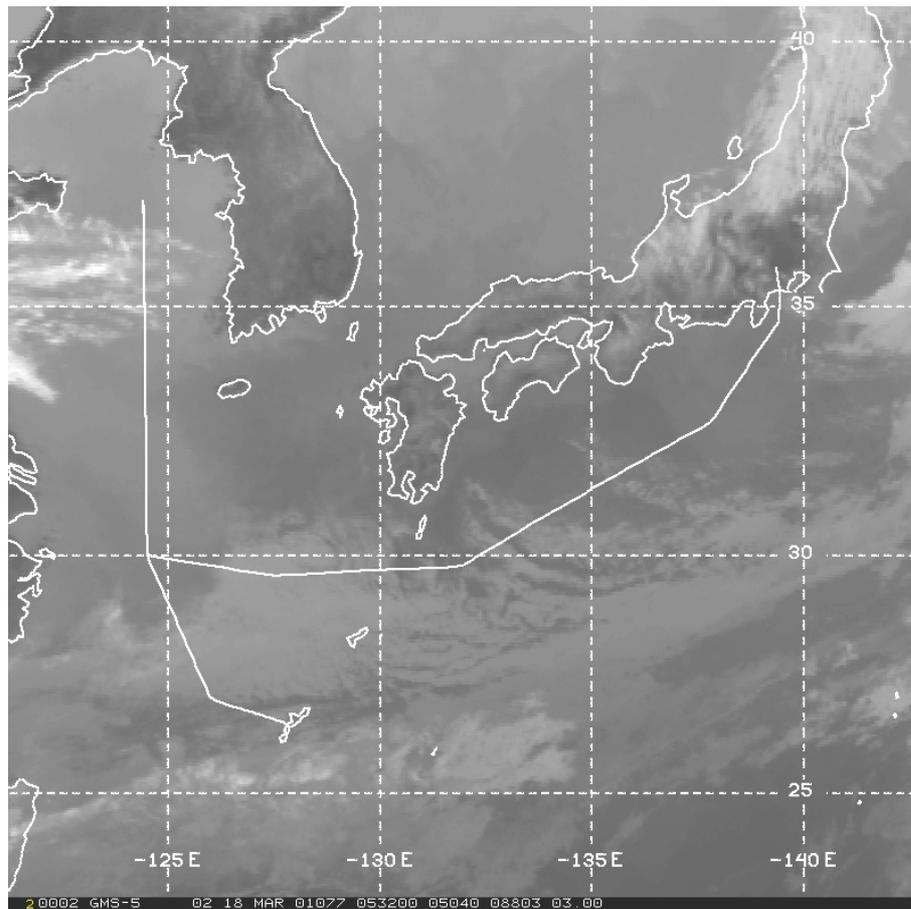
Results:

On the initial ascent from Hong Kong, an interesting layered structure was observed in CO, O₃, NO_y, and CN. 10 distinct layers were observed between the inversion (4.5Kft) and 19Kft. Moving eastward to the south of Taiwan, the atmosphere was fairly clean at all altitudes as expected. The first polluted conditions were encountered on a descent to the surface with CO exceeding 200 ppbv below 4000 ft. At 500 ft, NO_y exceeded 3 ppbv and NO was sustained in the 300-500 pptv range. During this time northerly winds were encountered although southerly winds were forecast. Over the Yellow Sea, CO maximized between 3000-7000 ft with sustained values above 400 ppbv and periods above 600 ppbv. Below 3000 ft, CO was less, around 200 ppbv. Conversely, NO_y and SO₂ were maximized near the surface at ppbv levels.

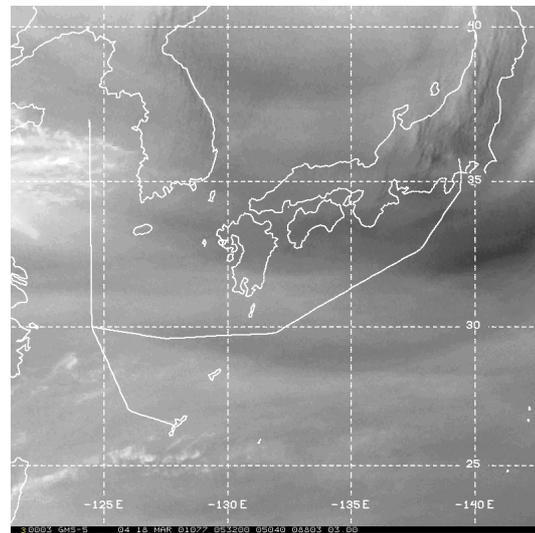
18 MAR 2001

P-3B: flight 14, Okinawa–Yokota, transit (20010318–20010318)

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P-3B flight 14 Narrative

Flight Summary:

This flight between Okinawa and Yokota was planned to include a northbound leg along 124.5E beginning at 30N stretching into the Yellow Sea up to 37N, then south again before heading east toward Yokota AFB, Japan. This mission was intended to sample the same area of the Yellow Sea as flight 13 to capture strong surface level outflow not present on the previous flight.

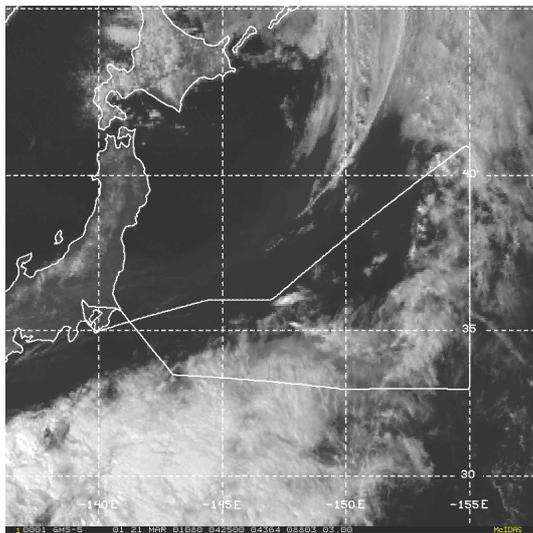
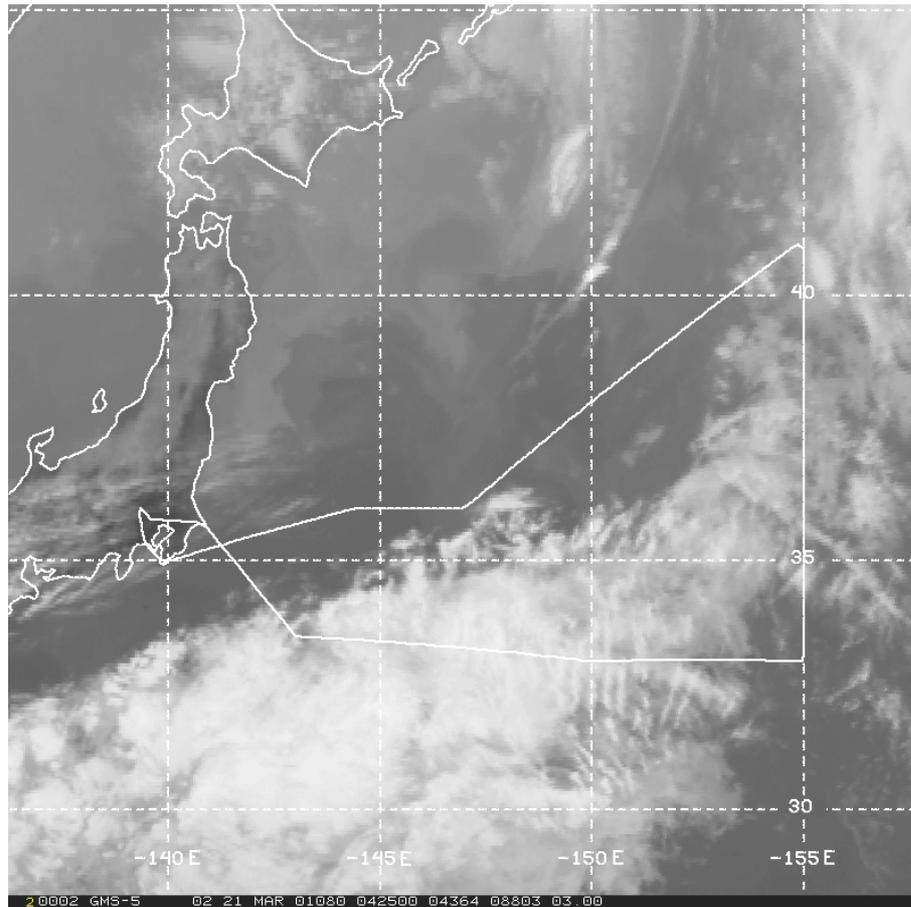
Results:

On the initial ascent from Okinawa, a layer of elevated CO and NO_y was observed between 5–10 Kft. Clean chemical conditions prevailed over the early portion of the flight into the Yellow Sea down to 5 Kft, although a large dust plume was encountered at 10Kft. The first polluted conditions were encountered on a descent from 5000 to 500 ft with the most polluted conditions persisting in the lowest 1000 ft. CO was sustained above 700 ppbv and exceeded 1 ppm. SO₂, NO_y, and PAN were also sustained above ppbv levels. Dust was also encountered several more times during the flight between 5 and 10 Kft. Flying eastward toward Yokota, volcanic emissions were encountered at 4.5 Kft with variations in SO₂ of several ppbv accompanied only by enhancements in CN and H₂SO₄. On the final leg into Yokota, O₃ reaching 122 ppbv was encountered at 18 Kft.

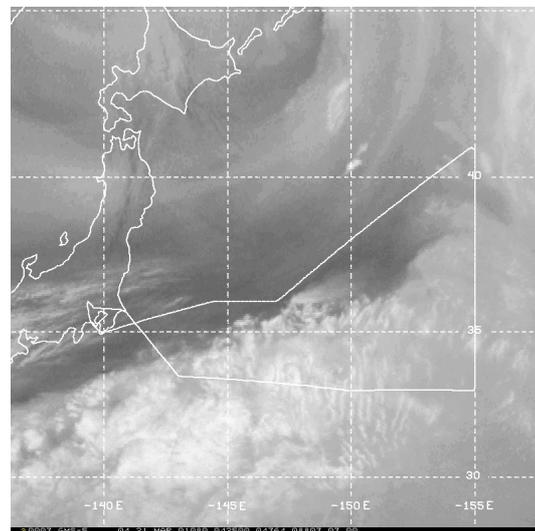
21 MAR 2001

P-3B: flight 15, Yokota local 1 (20010321-20010321)

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P-3B flight 15 Narrative

Flight Summary:

This flight to the east of Japan was intended to profile across a frontal boundary near 150E, sample beyond the front, and cross the frontal zone again on the return to Yokota.

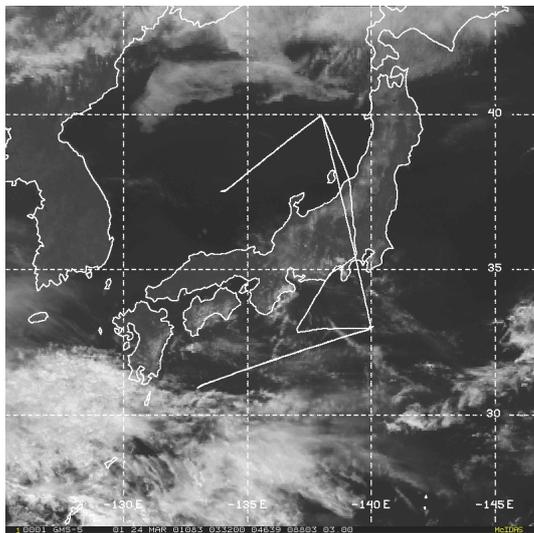
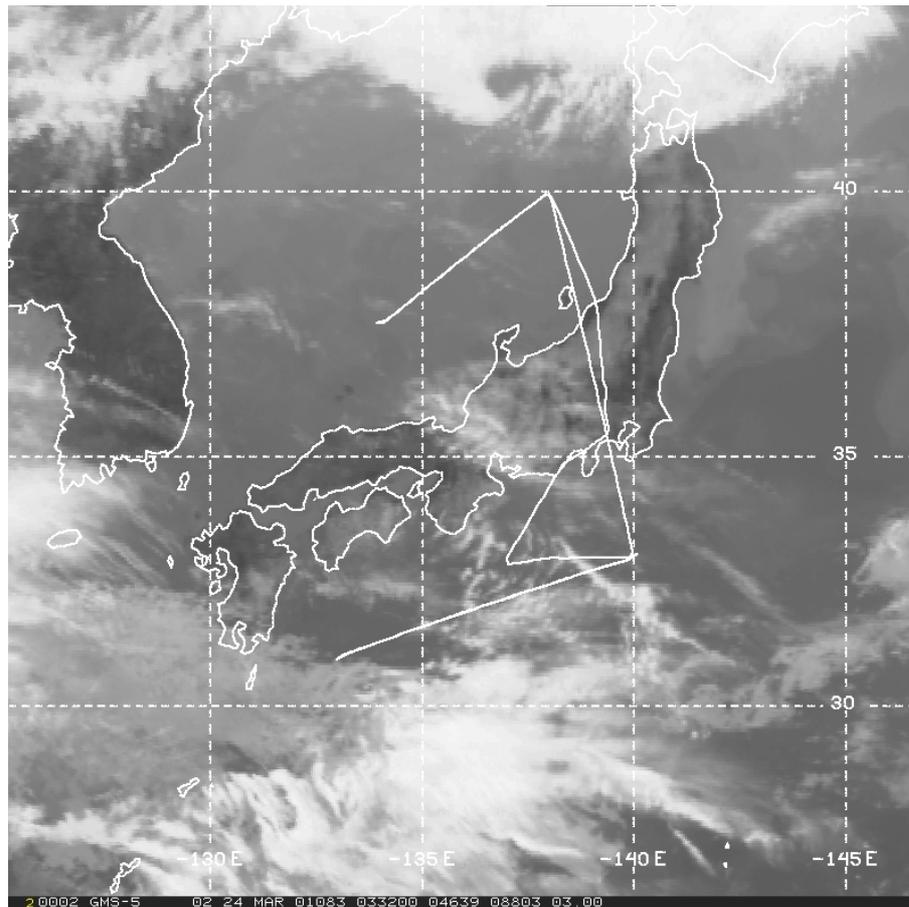
Results:

Heading out to the frontal zone, vertical profiles revealed ozone to be about 10 ppbv lower beyond the front. CO values were similar below 8 Kft and were lower beyond the front at higher altitudes. CO values were rather low both behind and beyond the front falling mostly in the 100–200 ppbv range. The vertical ascent at 40N fell within the frontal zone and showed almost no gradient in the CO (120 ppbv) and ozone (60 ppbv) profiles while relative humidity was near 100% between the surface and 15 Kft. Returning across the frontal zone, CO values remained less than 200 ppbv until reaching the boundary layer. At 5.5 Kft, evidence of new particle formation was reported by the UH group, and both ultrafine and fine particle counts showed a strong correlation with variations in NO_y. On the final boundary layer run, polluted air with CO up to 400 ppbv and NO_y up to 3 ppbv were observed. PAN was measured to be the dominant NO_y species through most of the flight often accounting for 40–50% of total NO_y. On the approach into Yokota, strong pollution encountered at 4 Kft included CO in excess of 700 ppbv, CO₂ in excess of 400 ppmv, NO_y greater than 20 ppbv, and PAN over 3 ppbv.

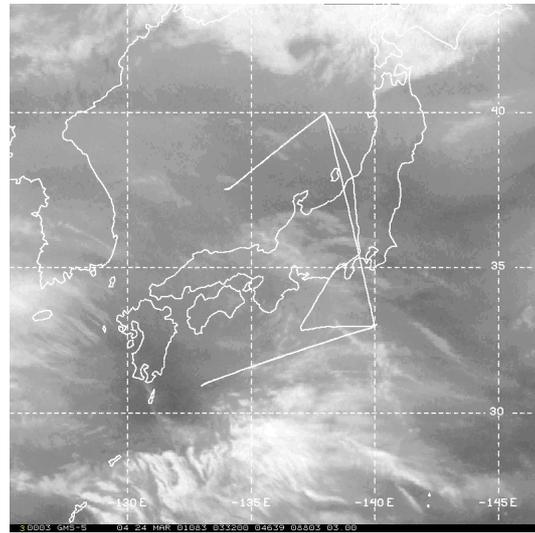
23 MAR 2001

P-3B: flight 16, Yokota local 2 (20010323-20010323)

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P-3B flight 16 Narrative

Flight Summary:

This flight was planned to begin with an intercomparison leg at 17 Kft with the DC-8. Following the intercomparison, low altitude sampling legs were planned along the southern coast of Japan and to the north in the Sea of Japan. Model predictions indicated both regions should have surface outflow below about 6 Kft with cleaner conditions above.

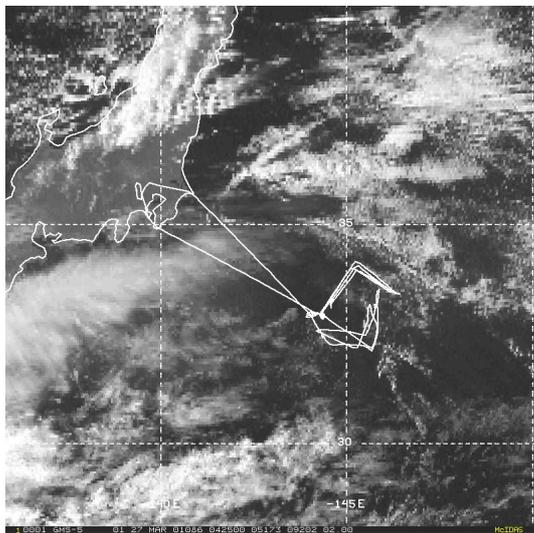
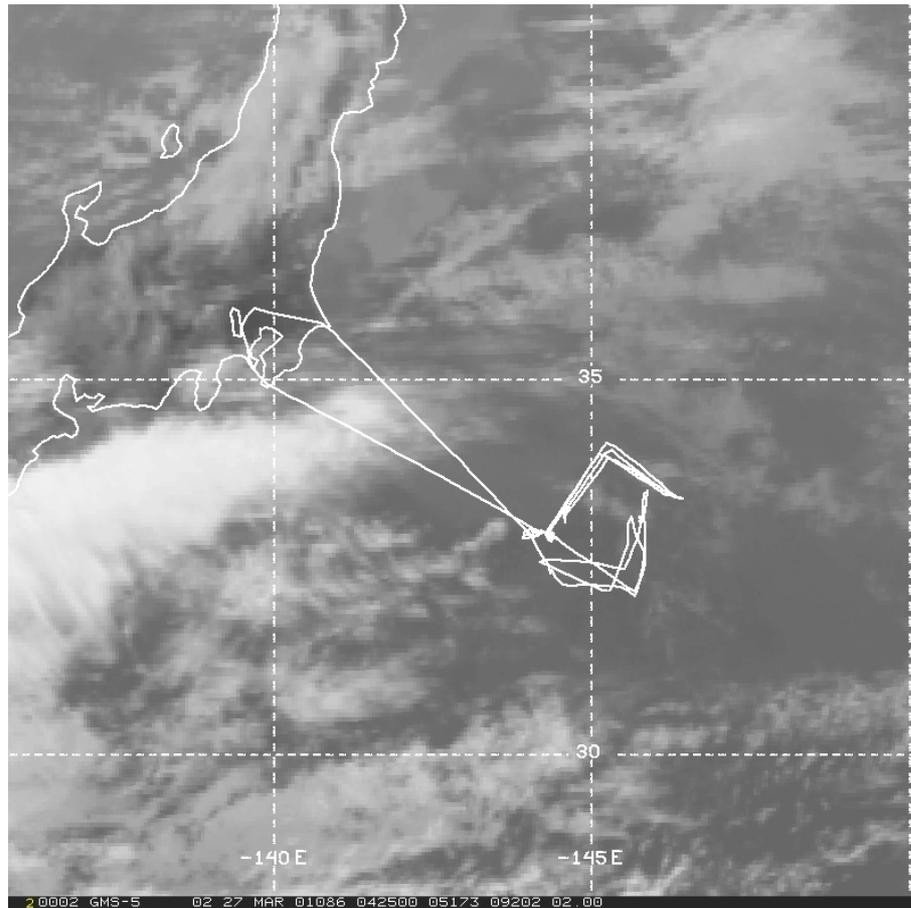
Results:

The intercomparison leg at the beginning of the flight went well. Conditions were fairly constant for most species, although ozone showed some variability ranging from 70 to 90 ppbv. Other measurements showed increased structure during a period of turbulence about 13 minutes into the 20 minute intercomparison. Sampling along the southern coast of Japan did show surface outflow below 6 Kft as expected. CO was highly variable with mixing ratios often in the 300 ppbv range and sometimes exceeding 400 ppbv. NO_y and SO₂ were consistently at ppbv levels. Crossing Japan to the north, very different conditions were encountered over the Sea of Japan. At all altitudes, CO rarely exceeded 200 ppbv and was often around 100 ppbv. Although background levels for all species were lower, several plumes were encountered from the boundary layer up to altitudes of 10Kft with ppbv level enhancements in SO₂ and NO_y (which had a large fraction attributed to PAN). These plumes also contained large enhancements in CN and smaller enhancements in ozone, CO, and DP. The Georgia Tech group reported that aerosol composition was similar to the north and south of Japan indicating a mixture of dust and anthropogenic aerosol. Despite the similarity in composition, aerosol mass loading was 5 times higher south of Japan as compared to the north.

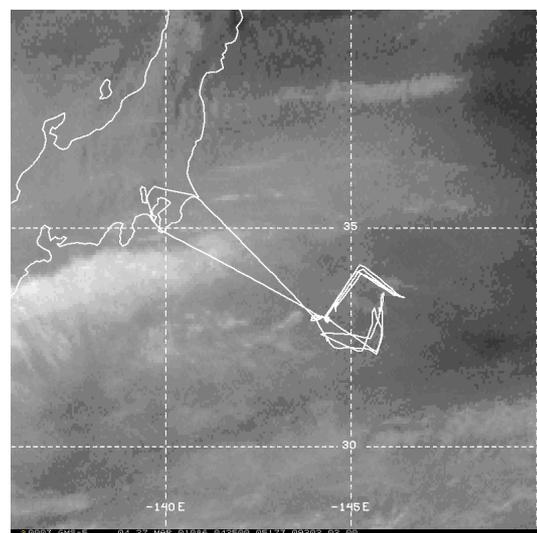
27 MAR 2001

P-3B: flight 17, Yokota local 3 (20010327-20010327)

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P-3B flight 17 Narrative

Flight Summary:

This flight was planned to investigate air-sea exchange through eddy correlation measurements based on high frequency sampling of SO₂ and CO₂ and data from TAMMS. The flight was planned for the marine boundary layer to the southeast of Japan (vic. 34N, 145E) where clear air and subsident conditions were expected to prevail, although the level of heterogeneity to expect in the airmass was uncertain. Potential problems with a volcanic plume from Miyake Jima were forecast by the U. Iowa model. A coincident overpass of the Terra satellite also offered an opportunity to provide a profile of aerosol properties useful in the validation of MISR.

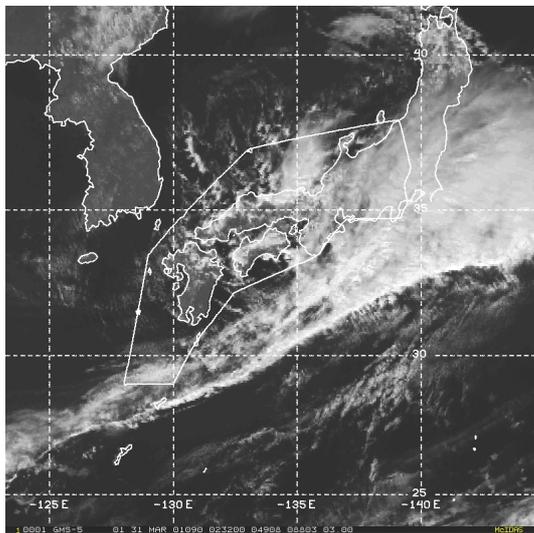
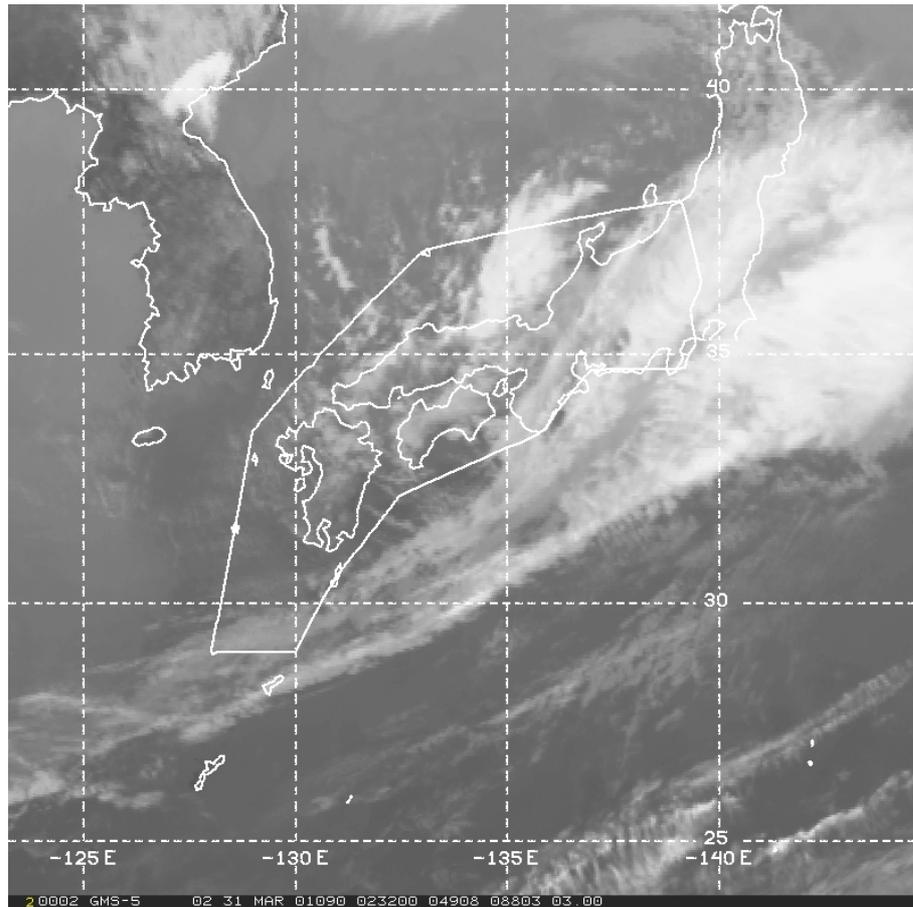
Results:

On the initial descent into the boundary layer southeast of Japan, intense pollution was encountered below 4000 ft with 2 ppbv NO_y, 20 ppbv SO₂, up to 300 pptv NO, evidence of new particle formation, etc. This layer was most likely a mix of pollution and volcanic emission from Miyake Jima. Stacked legs of 30 minute duration were flown in an L shape along and across the wind at 500, 800, and 1200 feet with a porpoising leg at 1800 feet. While conditions were not homogeneous, variations along the legs were consistent with one end being polluted and the other being relatively clean. After another sounding, another set of stacked legs were flown more to the south at altitudes of 500, 700, 1000, and 1200 feet. While the second set of legs began with more homogeneous conditions, the plume from Miyake Jima was clearly encountered along a portion of each leg with highly elevated SO₂ and CN with no response in other pollution tracers.

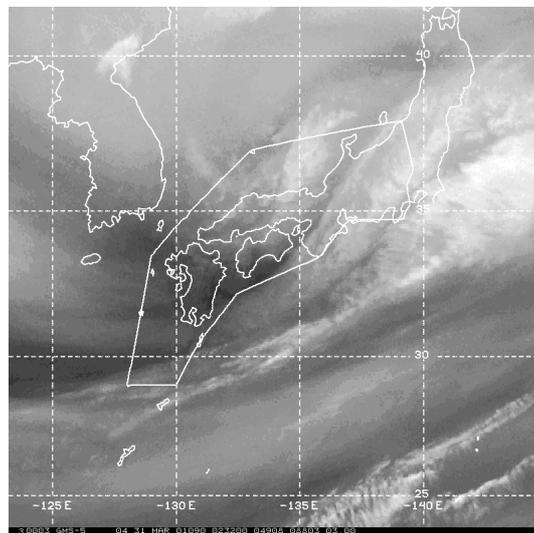
30 MAR 2001

P-3B: flight 18, Yokota local 4 (20010330-20010330)

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P-3B flight 18 Narrative

Flight Summary:

This flight was planned in coordination with the ACE-Asia science team which had just arrived at Iwakuni MCAS, Japan. A rendezvous with the NCAR C-130 was planned at 18 Kft over the Sea of Japan to be followed by several hours of proximity flying to the southwest between Japan and Korea and south along 129E sampling across a predicted axis of outflow from China associated with a frontal passage. Some special planned maneuvers included a spiral sounding from 18 Kft to 500 feet at the rendezvous point and another sounding to 12 Kft coinciding with an overpass of the Terra satellite. With a primary focus on trace gases for the NASA P-3B and a focus on aerosol properties on the NCAR C-130, this flight offers an unprecedented level of detail in characterizing the state of the atmosphere. It also provides a bridge between the aircraft for extending their datasets in terms of common measurements. These include packages on both aircraft from U. Hawaii for particle measurements, Georgia Tech for aerosol composition measurements, and Drexel for SO₂ measurements. Other common measurements include ozone, CO₂, and nonmethane hydrocarbons.

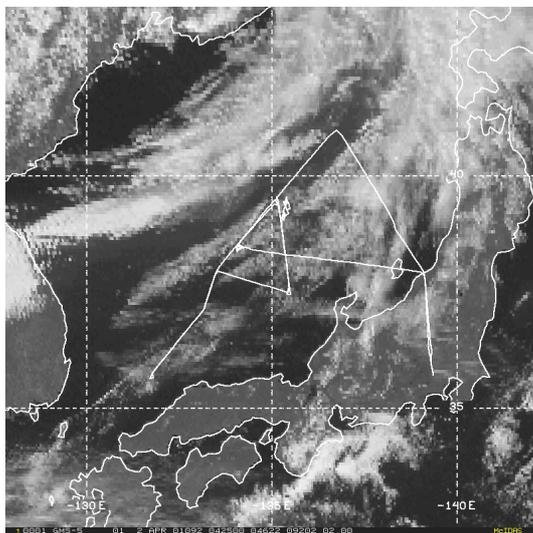
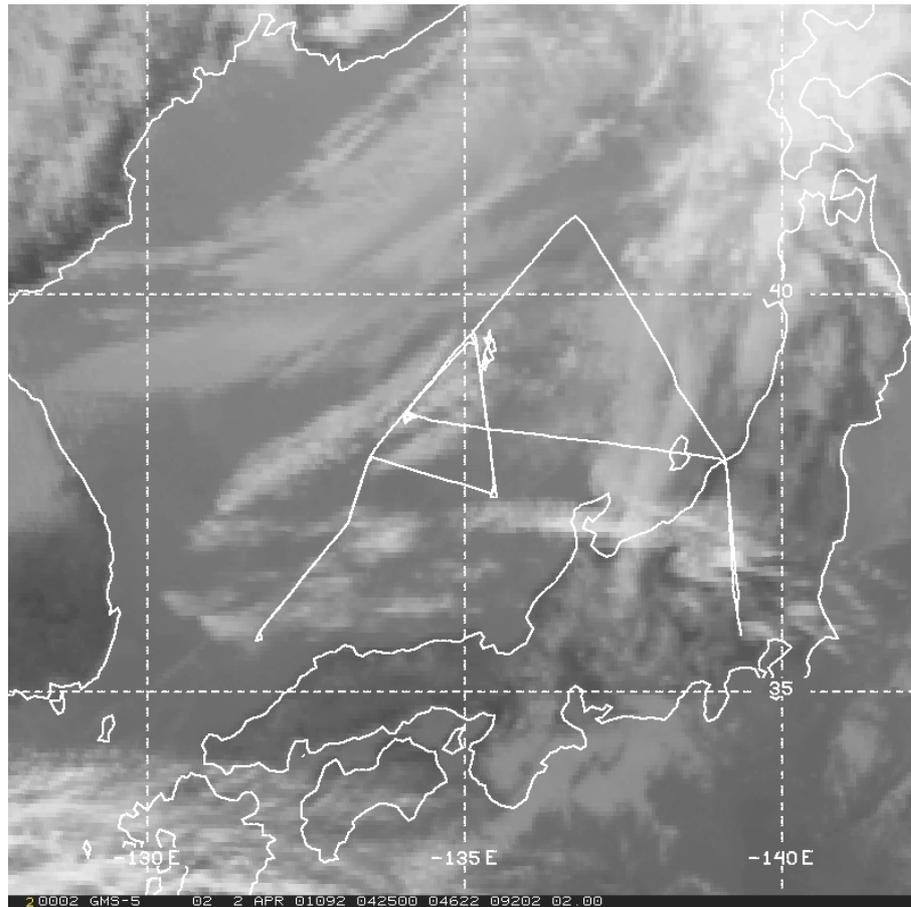
Results:

The P-3B transited at 18Kft from Yokota AFB to the rendezvous point (37N, 133E) over the Sea of Japan. Along this leg, high variability in all species were observed (e.g., CO 120-300 ppbv, NO_y 400-1500 pptv, SO₂ up to 1 ppbv). High chloride values reported by the Georgia Tech group indicating the presence of sea-salt suggest that this variability was caused by pollution that had been lifted and wrapped around the low pressure system located to the northeast. This system was the focus of the DC-8 flight for this day. The rendezvous was executed as planned and was followed by a spiral descent to 500 feet in broken cumulus clouds. This spiral was intended to allow column integration of in-situ aerosol measurements of aerosol optical depth for comparison to radiometer measurements on the NCAR C-130. From this point proximity flying was executed at several altitudes going southwest to (33.5N, 129E) then south to (29N, 128E). Along these legs, pollution was encountered mostly below 8000 feet with the most intense pollution centered around at 3000 feet (e.g., sustained values of CO 300-350 ppbv, NO_y 5-6 ppbv, NO over 700-1500 pptv, PAN 1-1.5 ppbv). A spiral ascent from 500 feet to 12 Kft and an immediate descent to 3 Kft was executed under clear skies at (31.5N, 128.5E) to coincide with the overpass of the Terra satellite. After 3 hours of proximity flight, the aircraft separated at (29N, 128E) with the P-3B heading back to Yokota. Flying to the south of Japan, layers of pollution and stratospheric influence (ozone up to 200 ppbv) were encountered between 12 Kft and 19 Kft in a region predicted to be along a boundary between stratospheric air and polluted air.

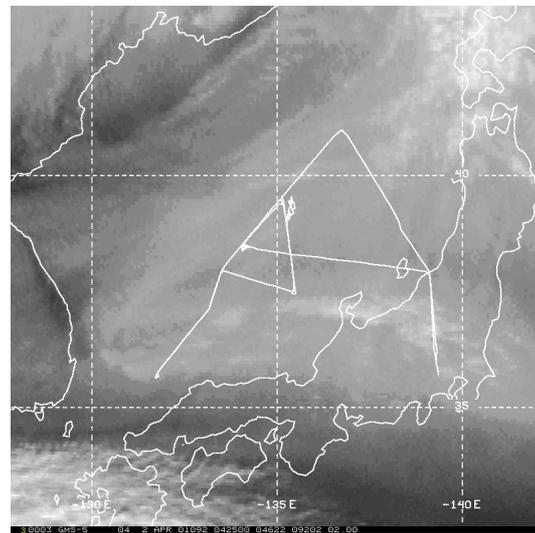
02 APR 2001

P-3B: flight 19, Yokota local 5 (20010402-20010402)

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P-3B flight 19 Narrative

Flight Summary:

This was the second of two flights coordinated with the ACE-Asia science team. The two aircraft again planned to sample both as a team and separately in outflow over the Sea of Japan. Model predictions indicated an axis of low level outflow predominantly below 2 km over the Sea of Japan. The NCAR C-130 planned to fly three stacked walls along the outflow at 133E, 135E, and 137E. A rendezvous with the NCAR C-130 was planned for (38.5N, 134E) to execute a joint spiral under the Terra satellite and jointly execute the stacked wall at 135E across the outflow axis. This was to be followed by extended wall sampling by the P-3B along the axis of outflow.

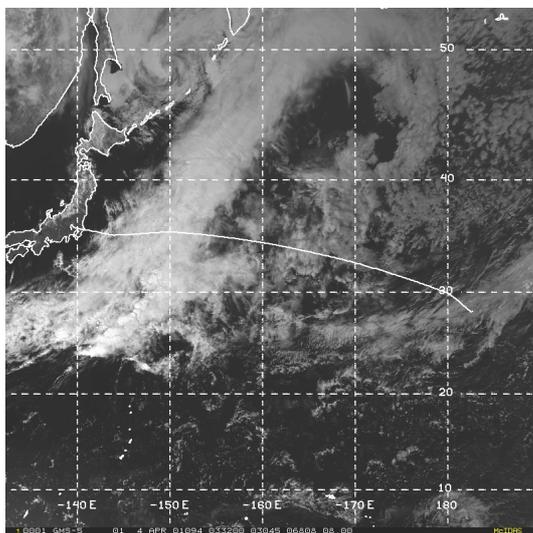
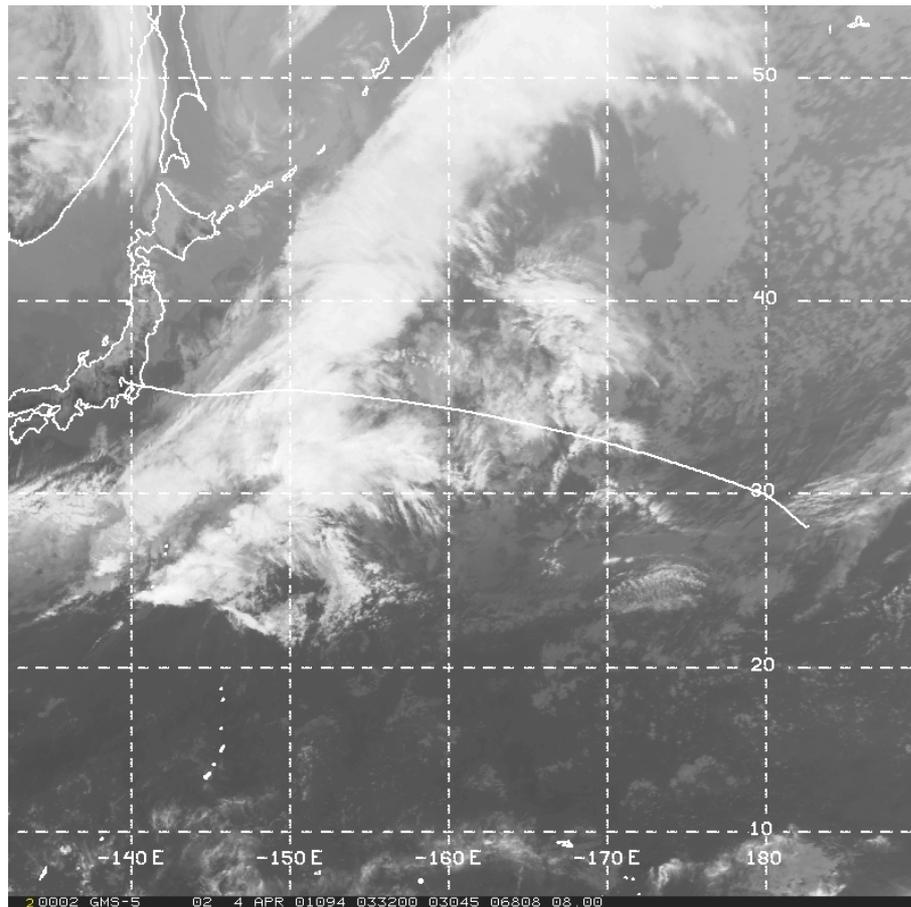
Results:

The P-3B transited at 18Kft from Yokota AFB to the rendezvous point over the Sea of Japan. Conditions along this leg were clean (e.g., O₃ 50-60 ppbv, CO 90-100 ppbv, NO_y 200-400 pptv). After joining the NCAR C-130, the joint spiral was performed with some degree of interference from broken clouds. Flight along the stacked wall was performed at altitudes of 500, 2000, and 4500 feet. Along each of these legs, more polluted conditions were encountered to the north, verifying the presence of the low level outflow (e.g., 320 vs 250 ppbv CO, 4 vs 2.5 ppbv NO_y, 2.5 vs 1 ppbv SO₂). Although the low level outflow was detected, along-axis profiling exposed an unexpected and more polluted layer at a higher altitude. This layer was extensively sampled (e.g., CO >400 ppbv, SO₂ up to 8 ppbv, NO_y up to 4 ppbv, PAN 1 ppbv, etc.) and determined to be between 8.5 and 12.5 Kft. Toward the end of the flight, a descent was performed at 41N, 137E. During this profile, the polluted layer was found to be entirely within a cloud layer between 8.5 and 12.5 Kft. This was followed by a 20 minute leg at 500 feet heading due south. During this leg, a shift in wind direction from 305 to 235 degrees signalled our crossing of the surface front. An ascent at the end of this leg at 39N, 138E resulted in a much cleaner profile providing a stark contrast to the profile at 41N (e.g., CO <100 ppbv and NO_y <400 pptv).

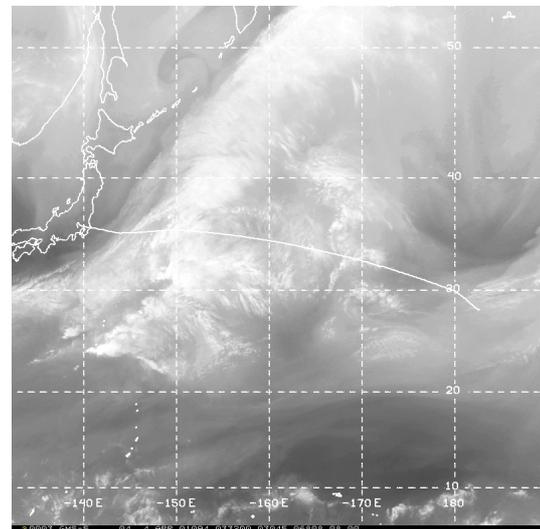
03 APR 2001

P-3B: flight 20, Yokota-Midway, transit (20010403-20010403)

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P-3B flight 20 Narrative

Flight Summary:

Time constraints required this flight to be flown directly between Yokota and Midway, although extensive in-progress vertical sampling was planned. The DC-8, which was headed for Kona, also planned to fly the same path between Yokota and Midway initiating profiles at 150E, 165E, and 180E. To complement the DC-8, low altitude sampling for the P-3B was planned to coincide with the DC-8's high altitude legs and vice versa.

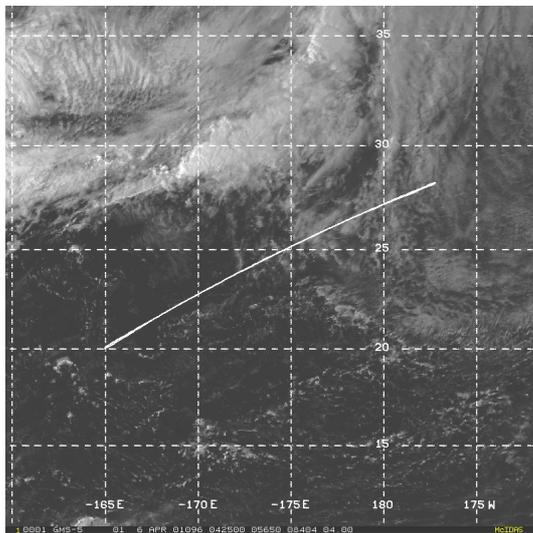
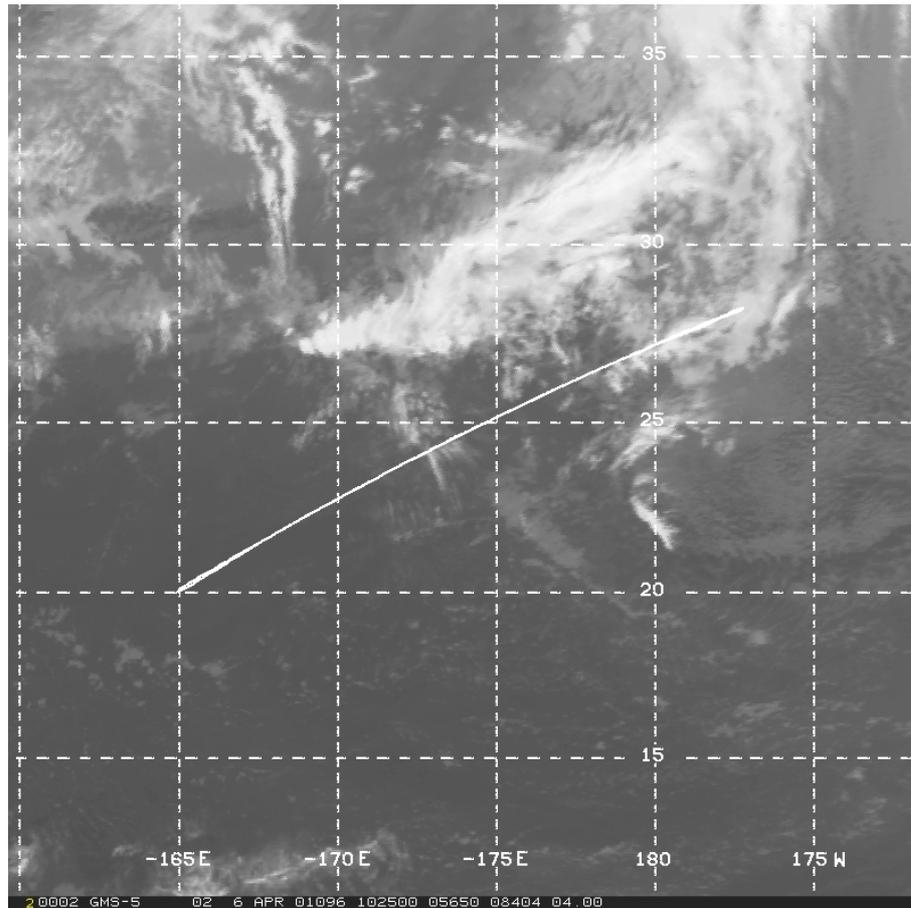
Results:

On the initial leg of 18 Kft out of Yokota, stratospheric air was sampled with O₃ up to 160 ppbv, NO_y ~600 ppbv, and CO ~70 ppbv. Following this, 3 profiles were completed along the flight track to Midway. These profiles revealed mild pollution below the inversion at ~5000 feet with CO between 130 to 200 ppbv, cleaner air above with CO mostly near or below 100 ppbv, and more polluted air at higher altitudes generally above 16 Kft with CO generally above 200 ppbv with brief episodes over 300 ppbv. On the second profile, a layer of stratospherically influenced air (e.g., O₃ up to 130 ppbv) was observed between 6.5 and 10.5 Kft.

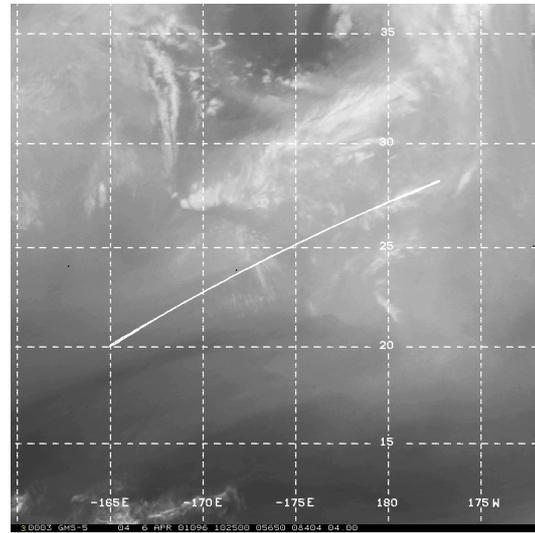
06 APR 2001

P-3B: flight 21, Midway local (20010406-20010406)

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P-3B flight 21 Narrative

Flight Summary:

Due to extensive bird traffic during daylight hours, this flight was planned for an evening takeoff (2000 hr) and a 0400 landing. The flight was planned to head southwest to 20N, 165E in the vicinity of Wake Island to investigate a predicted enhancement of CO above 700 mb (~3km). Some possibility of encountering stratospheric downwelling in the vicinity of Midway was also predicted.

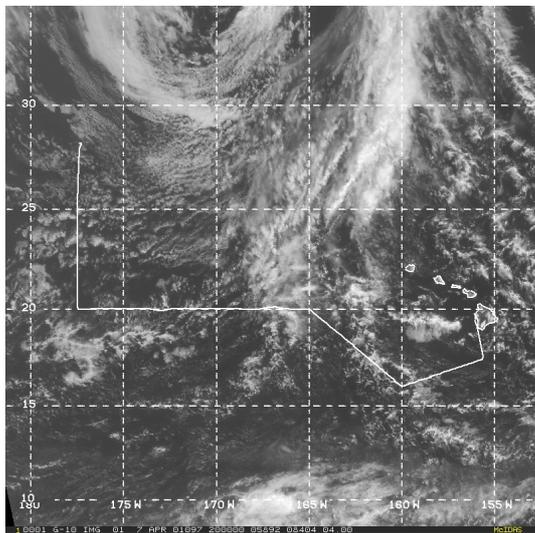
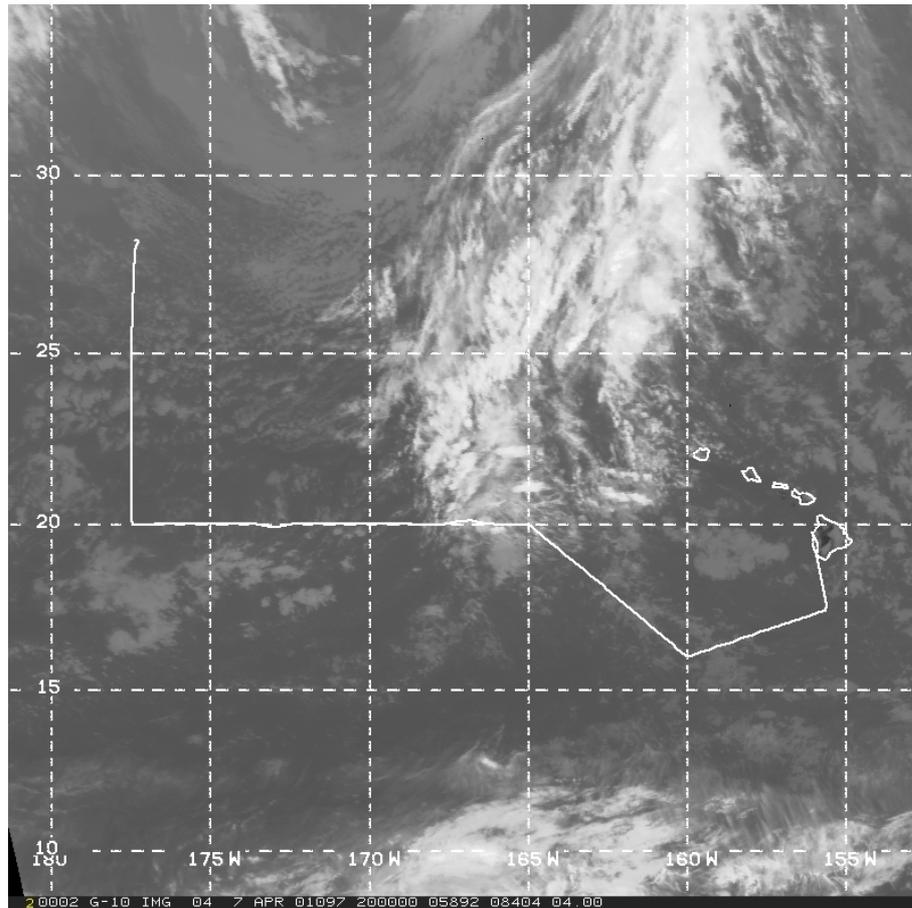
Results:

Although no stratospheric intrusions were encountered on this flight, the predominant signature was of stratospherically influenced air. O₃ (70–100 ppbv) was often anticorrelated with CO and dew point, but correlated with NO_y. Changes in NO_y were mostly due to HNO₃ while PAN changed little. CO observations were often 100 ppbv or less, although values up to 150 were observed with the greatest values observed toward the northern end of the flight track.

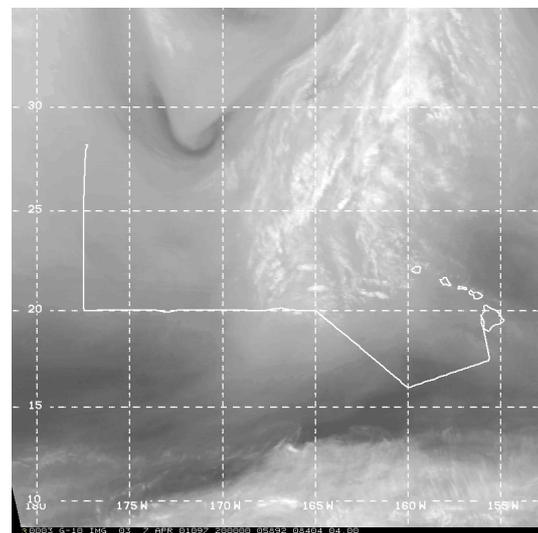
07 APR 2001

P-3B: flight 22, Midway-Kona, transit (20010407-20010407)

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P-3B flight 22 Narrative

Flight Summary:

This flight was planned to head due south from Midway to 20N then head due east in to Kona. A 0530 takeoff was planned to avoid daylight bird traffic over the runway. While the transit time to Kona did not allow the P-3B to take up a stationary pattern during sunrise, a constant altitude was flown throughout the sunrise period.

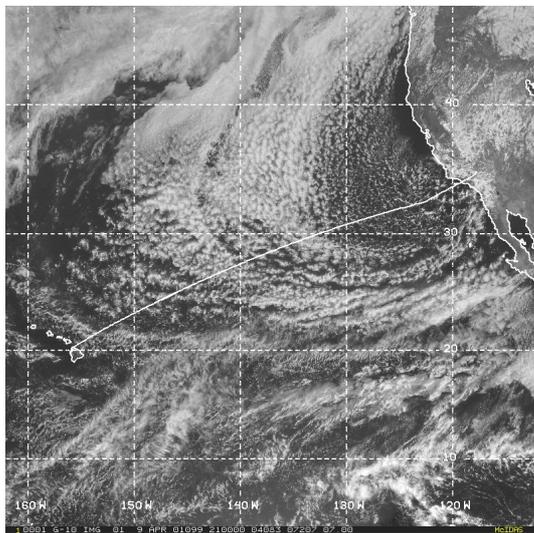
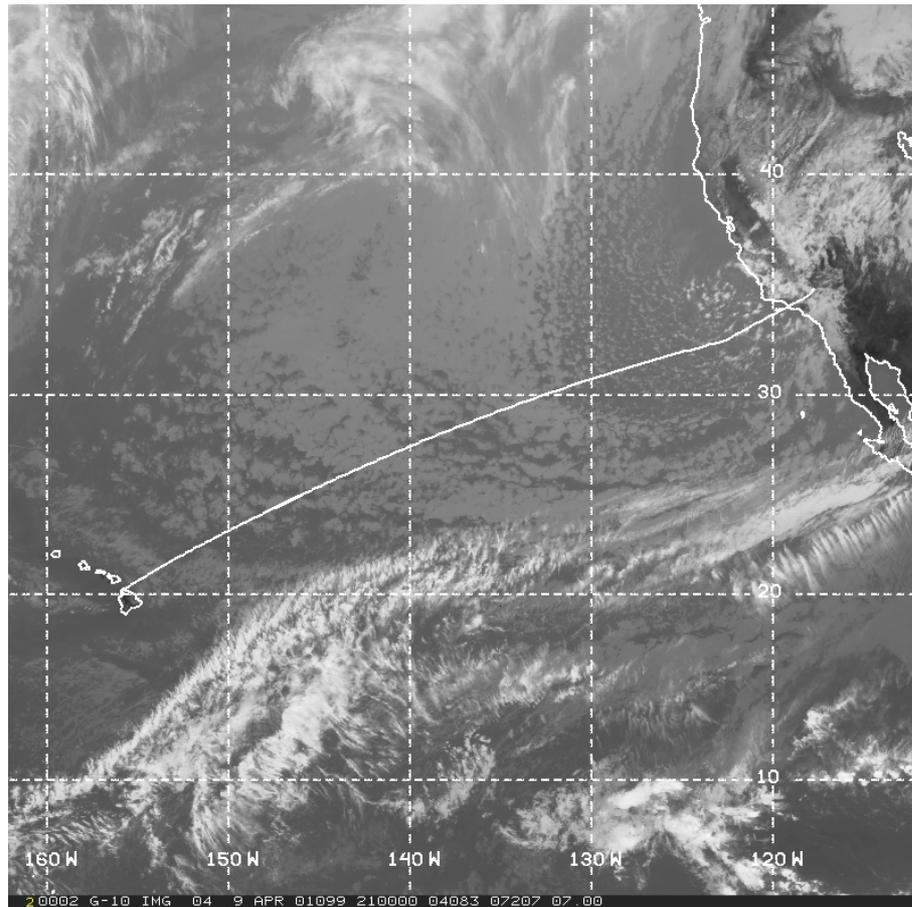
Results:

Leaving Midway, the P-3B ascended to 17.5 Kft. At this altitude, stratospheric influence was observed as O₃ increased from 50 ppbv to more than 100 ppbv while NO_y increased slightly from ~200 to ~300 pptv and CO remained steady at ~100 ppbv. Upon descending, the most promising altitude for the sunrise portion of the flight appeared to be about 13.5 Kft. Flight at this altitude encountered modest variability for the first hour, however, shortly after sunrise O₃ rapidly rose from 70 ppbv to 130 ppbv and conditions became extremely dry. This complicated any interpretation of OH with changing solar conditions. The predominant signature over the remainder of the flight was of stratospheric influence with several episodes of O₃ exceeding 100 ppbv and O₃ in the boundary layer of ~60 ppbv. CO remained mostly around 100 ppbv or less except for a thin layer at 19Kft containing 150 ppbv CO.

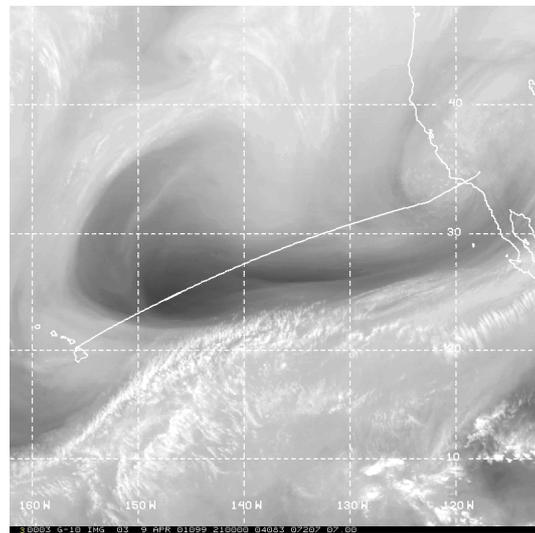
09 APR 2001

P-3B: flight 23, Kona-Dryden, transit (20010409-20010409)

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P-3B flight 23 Narrative

Flight Summary:

A final intercomparison between the P-3B and DC-8 was planned for this flight. The intercomparison was planned to include a 20 minute leg at 17.5 Kft, a descent to 1000 ft at 500 ft/min., and another 20 minute leg at 1000 ft. The P-3B then planned to turn 180 degrees and retrace the leg at 1000 ft to allow for a test of the Georgia Tech aerosol composition measurement with and without the removal of large particles (>1 micron). Given time constraints, the P-3B would then have to ascend to maximum altitude and proceed to Dryden.

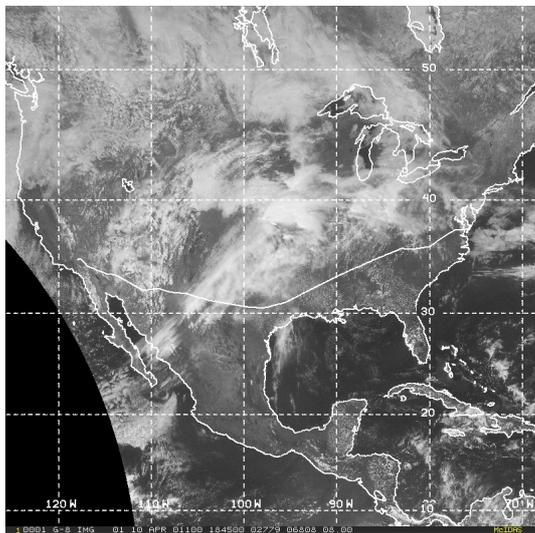
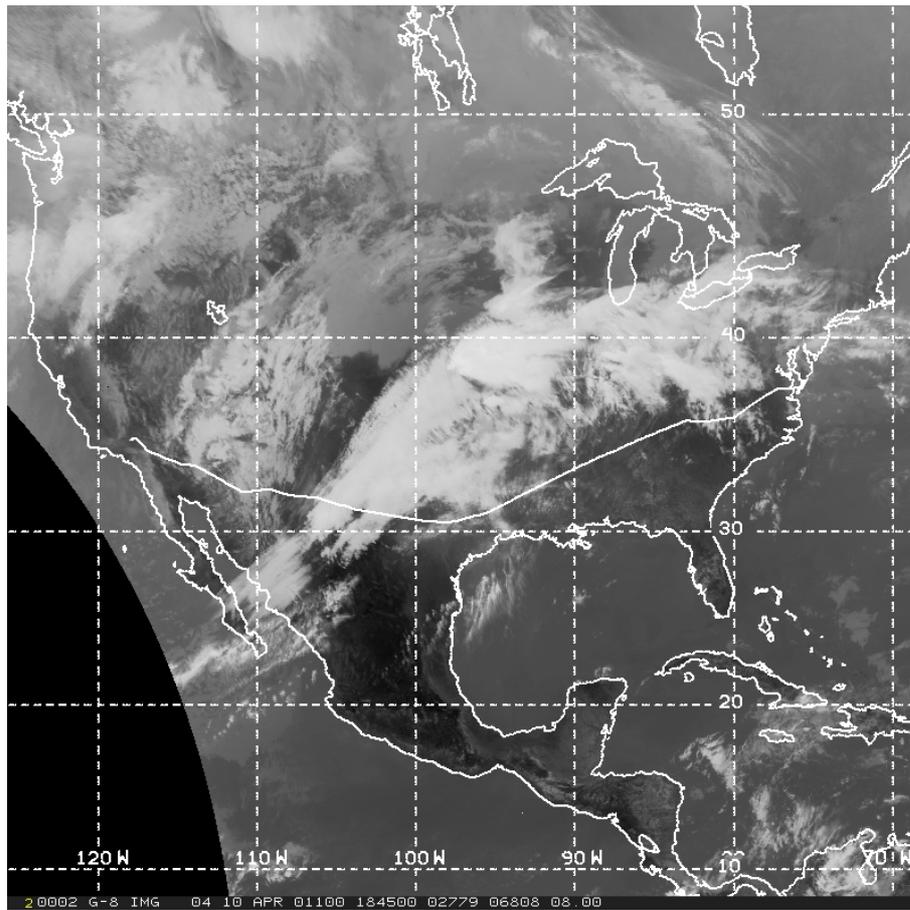
Results:

The intercomparison with the DC-8 went as planned with all instruments in operation. The reverse track at 100 feet also went as planned with similar conditions and no problems with encountering exhaust from the previous pass. At high altitude heading for Dryden, clean conditions (e.g., 65 ppbv O₃, 100 ppbv CO, 150 pptv NO_y) were encountered, followed by stratospheric conditions (e.g., O₃ >200 ppbv). At the end of the flight, convective activity over the west coast was encountered. Some large fluctuations in NO were observed (> 500 pptv). These fluctuations were most likely due to convective pumping of polluted air since the stormscope detected no lightning activity

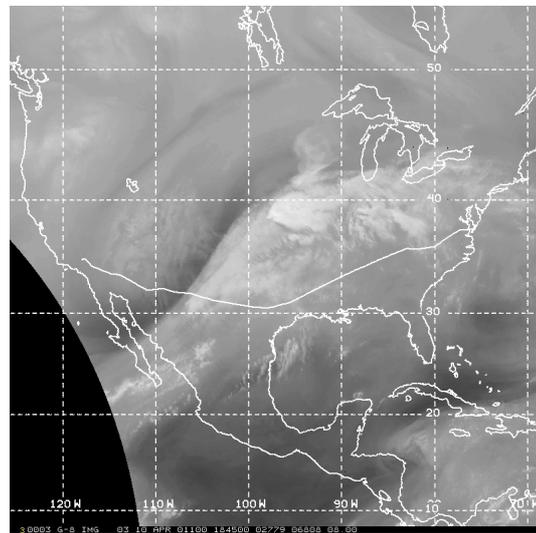
10 APR 2001

P-3B: flight 24, Dryden-Wallops, transit (20010410-20010410)

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P-3B flight 24 Narrative

Flight Summary:

This flight was planned to fly directly to from Dryden to Wallops with a stop to perform a spiral over the DOE CART site in Oklahoma where ground measurements for MOPITT validation are conducted. The only threat to this plan was a forecast for intense thunderstorm activity in the afternoon over Oklahoma.

Results:

The plan was scuttled early as the pilots were informed that convective cells over 50 Kft had already developed over Oklahoma by midmorning, earlier than expected. The aircraft was diverted to a more southerly route across Texas before heading northeast to Wallops. At a flight altitude of 21 Kft several airmass types were encountered that included both convected surface pollution and stratospheric air over the southwestern US. Over Texas, the cleanest airmass sampled during the entire TRACE-P mission was observed. This airmass contained 30 ppbv O₃, 40 ppbv CO, and 140 ppbv NO_y. While aerosol mass was very low, it was dominated by chloride signalling a marine origin. This air was most likely convected over the equatorial Pacific and transported in the southwesterly flow across Mexico and over Texas.